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Millipeds (Arthropoda: Diplopoda) of the Ark–La–Tex. VI. New Geographic Distributional Records from Select Counties of Arkansas

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Running Title: Millipeds (Arthropoda: Diplopoda) of the Ark–La–Tex. VI

Abstract

We continue to report, in the sixth of a series of papers, new geographic records for millipeds of the state, including noteworthy records for some taxa collected from Crowley's Ridge in eastern Arkansas. This contribution documents 47 new co. records and includes records for 19 species within 9 families and 5 orders. More uncommon millipeds found included *Okliulus carpenteri* (Parajulidae), *Eurymerodesmus newtonus* (Eurymerodesmidae), *Pseudopolydesmus minor* (Polydesmidae) and undescribed species of *Ethojulus* (Parajulidae) and *Nannaria* (Xystodesmidae). Undoubtedly, additional records will be reported in the future as several gaps in the distribution of Arkansas millipeds remain.

Introduction

Millipeds (Class Diplopoda), despite their ecological importance for soil nutrient cycling, are grossly understudied and under-appreciated. Over the last decade, however, considerable information has been documented on the millipeds of Arkansas. Indeed, several papers appeared during that period including some that were monograph in length (see McAllister and Robison 2009, 2011, Shelley et al. 2012). Here, we continue to disseminate that information with additional co. records for some millipeds of the state.

Materials and Methods

Between August 1992 and April 2013, we followed techniques of McAllister and Robison (2009) in collecting millipeds from sites (including pitfall traps) in 24 counties throughout the state (Fig. 1). Specimens were placed in vials containing 70% ethanol and, following preliminary identification,

representative samples were shipped to R. M. Shelley at the North Carolina State Museum of Natural Sciences (NCSM), Raleigh, for verification of identifications and deposition of vouchers. Other specimens were deposited in the Sam Noble Museum (OMNH), University of Oklahoma, Norman. Below, taxonomy is presented in the same order as in Shelley's (2003) classification. Collectors of most of the specimens are the coauthors who are designated below by their initials.

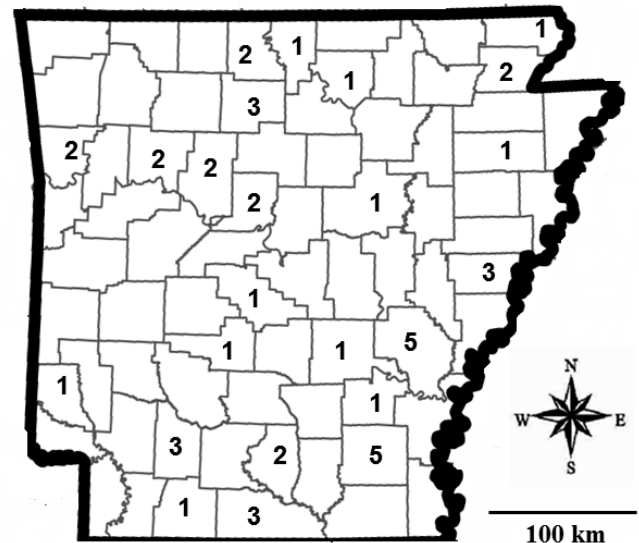


Figure. 1. Twenty-four Arkansas counties with number of millipede species (47 new county records) collected in each.

Crowley's Ridge. – We made collections of millipeds from the northern (Clay and Green cos.) and central (Craighead Co.) to near the southern (Lee Co.) extent of Crowley's Ridge in eastern Arkansas (Fig. 2). This physiographic region is an unusual geological formation dominated by oak and hickory forest that rises 170 m above the alluvial plain of the Mississippi Embayment in a 240 km line from southeastern

Missouri to the Mississippi River near Helena, Phillips Co. (Foti 1974, his map 4). The ridge is also unique in soil type as a post-glacial loessial deposit capped with wind-deposited silt predominate (Foti 1974, his map 4). Shelley et al. (2012) recently reported *Euryurus leachii* from 3 counties of the ridge, only the second report of this milliped from west of the Mississippi River.

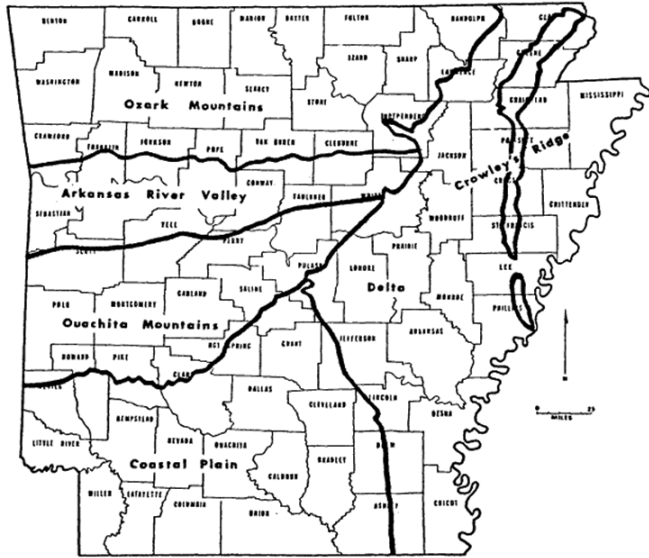


Figure 2. Physiographic regions of Arkansas, including location of Crowley's Ridge in eastern part of state.

Annotated List of Taxa

Julida: Blaniulidae

Virgoiulus minutus (Brandt). – **Poinsett Co.**, Lake Poinsett State Park (35.532378°N, 90.685608°W), ♀♀, 20 Nov. 2010. CTM & HWR. NCSM. These individuals (> 20) were collected on Crowley's Ridge and found underneath peeled decaying pine bark, which is typical microhabitat for *V. minutus*. This slender-bodied milliped has a widespread Arkansas range and has been reported previously from 19 cos. (McAllister et al. 2002b, 2003-their fig. 3, 2005-their fig. 1, McAllister and Robison 2011).

Parajulidae*

*Note: R. M. Shelley (NCSM) is currently revising this family and parajulid taxa are expected to experience nomenclatural changes in the future.

Ethojulus sp. Chamberlin. – **Columbia Co.**, Magnolia (33.207°N, 92.666°W), ♂♂, 10 Dec. 2007, J. Sneed. Waldo (33.351°N, 93.295°W), ♂♂, 22 Nov. 2007 & 10 Feb. 2008. V. Briggs, HWR. NCSM. **Union Co.**, Mt. Holly (33.302°N, 92.954°W), ♂, 22 Nov. 2007, L. Lewis. El Dorado, ♂, 19 Sept. 2007,

HWR. NCSM. These likely represent an undescribed species and are currently being studied by R. M. Shelley. Nevertheless, the genus is reported from these 2 counties and the poorly sampled Coastal Plain of the state for the first time.

Okliulus carpenteri Causey. – **Drew Co.**, POW Camp Natural Area, UAM School Forest (33.620144°N, 91.725928°W), ♂♂, 15 Oct. 1992. LCT. NCSM. This parajulid was originally described from Wilburton, Latimer Co., Oklahoma (Causey 1950). It is also known from Sebastian Co., Arkansas (Causey 1953). Another species is known to occur in Arkansas, *Okliulus beveli* Causey from Junction City, Union Co. (Causey 1953), while *Okliulus foliatus* Loomis was reported from Bossier Parish, Louisiana (Loomis 1968).

Oriulus venustus (Wood). – **Calhoun Co.**, 1.0 km N of Calion (33.339277°N, 92.536983°W), ♂, 8 Apr. 2010. MBC. NCSM. **Union Co.**, Smackover (33.3648°N, 92.7248°W), ♂, 8 Apr. 2010. MBC. NCSM. This commonly encountered species was previously reported from 9 cos. (Shelley 2002, McAllister et al. 2003); we document 2 new co. records for the southcentral portion of the state (Fig. 3). This milliped is the most widespread native milliped species in North America (Shelley and Snyder 2012), but genuine vouchers are now known from only 11 (15%) of Arkansas cos.

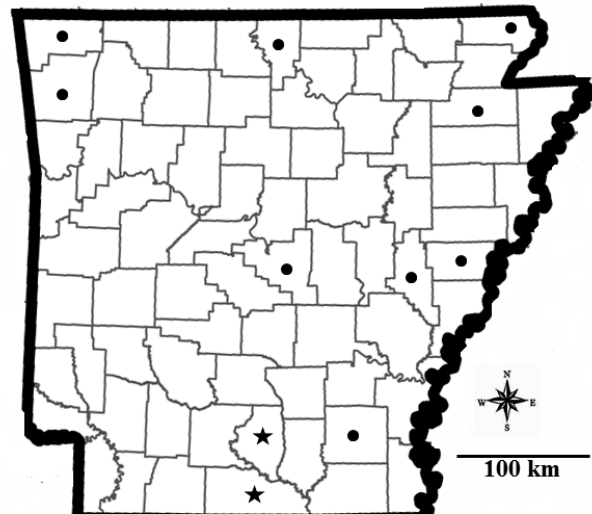


Figure 3. Records of *Oriulus venustus* in Arkansas. Dots = previous records; stars = new records.

Platydesmida: Andrognathidae

Brachycybe lecontii – Wood. **Crawford Co.**, Natural Dam off Natural Dam Road (36.214104°N, 92.682745°W), unsexed specimen, 19 Apr. 2013. CTM

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& HWR. OMNH. This colorful pink to red species now occurs in 29 cos. of the Ouachita and Ozark uplands (Shelley et al. 2005). We did not record sex because this milliped is the only representative of the order in the state that can be authentically identified with either gender and/or with juveniles. Brewer et al. (2012) recently provided a phylogenetic analysis showing that extant individuals of *B. lecontii* appear to have originated in the Appalachian Mountains and migrated to the Ozark Mountains (~3 mya).

Spirobolida: Spirobolidae

Narceus americanus (Palisot de Beauvois). – **Arkansas Co.**, Arkansas Post National Memorial off, St. Hwy. 6 on Post Bayou Trail (34.02057°N 91.349336°W), 9 Apr. 2011. OMNH. CTM & HWR. **Calhoun Co.**, 6.4 km W of Harrell (33.535099°N, 92.539215°W), 4 Apr. 2012. MBC. OMNH. **Conway Co.**, ~5.0 km SE of Pontoon, 2.5 km S junction St. Hwy 155/ St. Hwy. 154 on 155 (35.092182°N, 92.957296°W), ♂, 19 Apr. 2013, MBC. OMNH. **Drew Co.**, POW Camp Natural Area, UAM School Forest (33.620144°N, 91.725928°W), 17 Sept. 1992. LCT. NCSM. **Greene Co.**, Crowley's Ridge State Park off Spider Creek Trail (34.042652°N, 90.664261°W), 26 Feb. 2010. CTM & HWR. NCSM. **Hot Spring Co.**, DeRoche off St. Hwy. 84 (34.330209°N, 93.047628°W), 27 May 2011. CTM. OMNH. **Jefferson Co.**, 13.7 km SW of Pine Bluff along St. Hwy. 79 (34.122037°N, 92.123108°W), 12 Nov. 2005. HWR. NCSM. **Nevada Co.**, Arkansas Oak Natural Area (35.201105°N, 91.831833°W), Jul.-Aug. 2011. MBC. OMNH. This milliped complex (*N. americanus-annularis*) is expected statewide but genuine vouchers have been reported from less than one-half of Arkansas cos. (Shelley et al. 2006, McAllister and Robison 2011).

Callipodida: Abacionidae

Abacion texense (Loomis). – **Baxter Co.**, 3.2 km NW of City Rock Bluff (36.123802°N, 92.226105°W), ♂, 16 Apr. 2011. CTM. OMNH. **Drew Co.**, POW Camp Natural Area, UAM School Forest (33.620144°N, 91.725928°W), ♂♂, 13-19 Aug. 1992. LCT. NCSM. **Marion Co.**, vic. Mull, 1.0 km E of jct. St. Hwy. 14 and St. Hwy. 268E (36.074112°N, 92.602386°W), 22 Mar. 2011, ♂♂, MBC. OMNH. **Nevada Co.**, 11.2 km N of Willisville, ♂♂, 24 Nov. 2005. HWR. Arkansas Oak Natural Area (35.201105°N, 91.831833°W), ♂♂, 10-17 Apr. 2011 & Jul.-Aug. 2011. MBC. OMNH. **Pope Co.**, 3.2 km NE of Bayou Bluff off St. Hwy. 27 (35.555692°N,

92.92099°W), ♂, 22 Apr. 2010. CTM. NCSM. **Searcy Co.**, vic. Mull, 3.0 km S jct. St. Hwy. 14/Ramblewood Trail (36.071320°N, 92.582495°W), ♂, 22 Mar. 2011. MBC. OMNH. McAllister and Shelley (2010-see their fig. 1) summarized records of *A. texense* in the USA and reported previous Arkansas records in mostly the western part of the state from the Ozark and Ouachita plateaus.

Abacion tessellatum Rafinesque. – **Union Co.**, El Dorado, Grady Bell Road (33.216978°N, 92.585893°W), ♂, 8 Nov. 2011. MBC. OMNH. This species has been previously reported from 9 cos. in various parts of the state (Shelley 1984, Shelley et al. 2003, McAllister and Robison 2011). We document a new co. record and the southernmost distribution for *A. tessellatum* in Arkansas (Fig. 4).

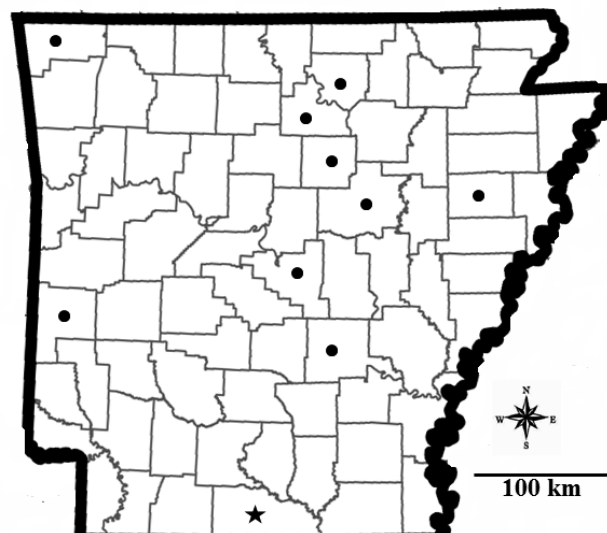


Figure. 4. Records of *Abacion tessellatum* in Arkansas. Dots = previous records; star = new record.

Polydesmida: Eurymerodesmidae

Eurymerodesmus angularis Causey. – **Arkansas Co.**, Arkansas Post National Memorial, Post Bayou Trail (34.02057°N, 91.349336°W), ♂, 9 Apr. 2011. CTM & HWR. Roth Prairie Natural Area (34.435487°N, 91.576030°W), ♂, 22 May 2009. LCT. NCSM. **Drew Co.**, POW Camp Natural Area, UAM School Forest (33.620144°N, 91.725928°W), ♂, 9 Oct. 1992. LCT. NCSM. Additional records of *E. angularis* in the state include Columbia, Jefferson, IZard, Ouachita, Phillips, Prairie, and Union counties (Shelley 1990; McAllister et al. 2004).

Eurymerodesmus birdi birdi Chamberlin. – **Johnson Co.**, Clarksville, Clark Road (35.46198°N, 93.499822°W), ♂, 15 Mar. 2008. J. Kremers. NCSM. This milliped has been reported previously from only 8

cos. in the western and northwestern part of the state (Shelley 1990, McAllister et al. 2003). We document a new county record in the Arkansas River Valley (Fig. 5).

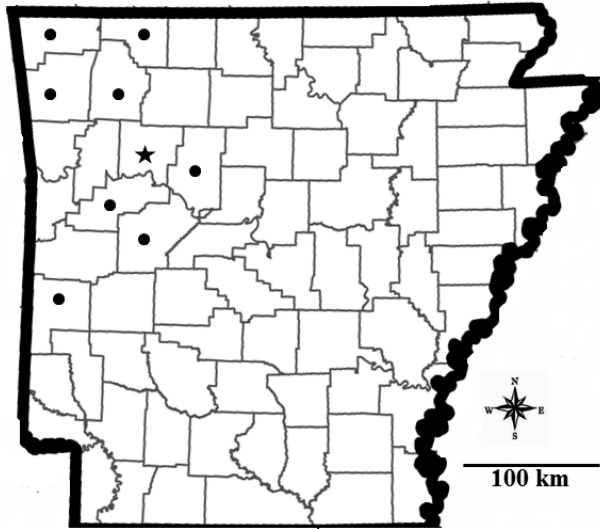


Figure 5. Records of *Eurymerodesmus birdi birdi* in Arkansas. Dots = previous records; star = new record.

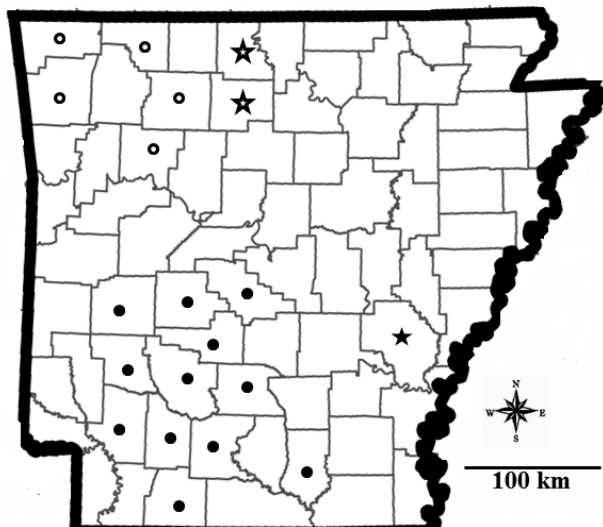


Figure 6. Records of *Eurymerodesmus dubius* and *E. newtonus* in Arkansas. Open dots (previous records, *E. newtonus*); open dot in stars (new records, *E. newtonus*); dots (previous records, *E. dubius*); star (new record, *E. dubius*).

Eurymerodesmus dubius Chamberlin. – **Arkansas Co.**, Roth Prairie Natural Area (34.435487°N, 91.576030°W), ♂, 22 May 2009. LCT. NCSM. Previous records in the state include 12 counties in the central and southcentral part of the state (Shelley, 1990, McAllister et al. 2002a, b). The Arkansas Co. record documented herein represents the easternmost locality in the state for *E. dubius* (Fig. 6). This eurymerodesmid is somewhat similar in

appearance to *E. mundus* Chamberlin but possesses quite different aperture lobes and gonopods (Shelley 1990).

Eurymerodesmus newtonus Chamberlin. – **Marion Co.**, vic. Mull, 1.0 km E of jct. St. Hwy. 14 and St. Hwy. 268E (36.074112°N, 92.602386°W), 22 Mar. 2011, ♂, MBC. OMNH. **Searcy Co.**, vic. Mull, 3.0 km S jct. St. Hwy. 14/Ramblewood Trail (36.071320°N, 92.582495°W), ♂♂, 22 Mar. 2011. MBC. OMNH. This Arkansas endemic had been previously reported from 5 northwestern cos. of the Ozark Plateau (McAllister and Robison 2011). We report 2 new co. records and extend the range eastward (Fig. 6).

Euryuridae

Auturus evides (Bollman). – **Arkansas Co.**, Roth Prairie Natural Area (33.620144°N, 91.725928°W), ♂, 22 May 2009. LCT. NCSM. **Crawford Co.**, Natural Dam off Natural Dam Road (36.214104°N, 92.682745°W), ♂♂, 28 Apr. 2012. CTM & HWR. OMNH. This milliped occurs exclusively north of the Arkansas River in 21 cos. (Shelley 1982, McAllister and Robison 2011, Shelley et al. 2012, their fig. 2) (Fig. 7).

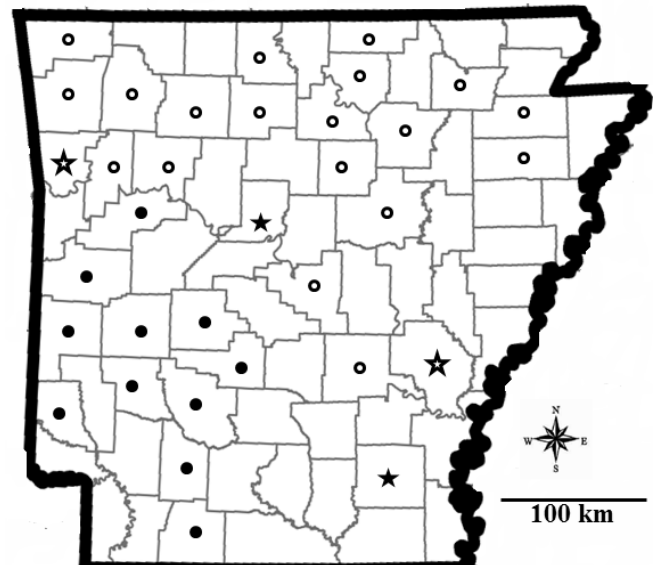


Figure 7. Records of *Auturus evides* and *A. l. louisianus* in Arkansas. Open dots (previous records, *A. evides*); open dot in stars (new records, *A. evides*); dots (previous records, *A. l. louisianus*); stars (new records, *A. l. louisianus*).

Auturus louisianus louisianus (Chamberlin). – **Conway Co.**, ~5.0 km SE of Pontoon, 2.5 km S junction St. Hwy 155/ St. Hwy. 154 on 155 (35.092182°N, 92.957296°W), ♂, 19 Apr. 2013, MBC. OMNH. **Drew Co.**, POW Camp Natural Area, UAM School Forest (33.620144°N, 91.725928°W), ♂, 6 Aug.

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1992. NCSM. Unlike *A. evides*, this milliped occurs exclusively south of the Arkansas River and previous records include 11 cos. (Shelley 1982, McAllister and Robison 2011, Shelley et al. 2012, their fig. 2) (Fig. 7). The Conway Co. record was from south of the Arkansas River. We document herein the easternmost record for the state.

Xystodesmidae

Apheloria virginiensis reducta Chamberlin. – **Izard Co.**, Calico Rock at Rand City Park off St. Hwy. 5 (36.123711°N, 92.144791°W), ♂, 16 Apr. 2011. CTM & HWR. OMNH. **Lee Co.**, Bear Creek Recreation Area at Bear Creek Lake (34.704364°N, 90.692482°W), ♂♂, 27 Feb. 2010 & 21 Nov. 2010. CTM & HWR. NCSM. **Saline Co.**, vic. Paron at Flatside Wilderness Area (34.783637°N, 92.777653°W), ♂, 7 Apr. 2010. B. Crump. NCSM. This colorful and attractive xystodemid has previously been reported from upland sites in Baxter, Benton, Carroll, Cleburne, Conway, Craighead, Fulton, Greene, Independence, Johnson, Lawrence, Logan, Marion, Newton, Polk, Pope, Randolph, Scott, Searcy, Sharp, Stone, Van Buren, and Washington cos. (Shelley and McAllister 2007). Our Lee Co. site is noteworthy as it was located on Crowley's Ridge in northeastern Arkansas.

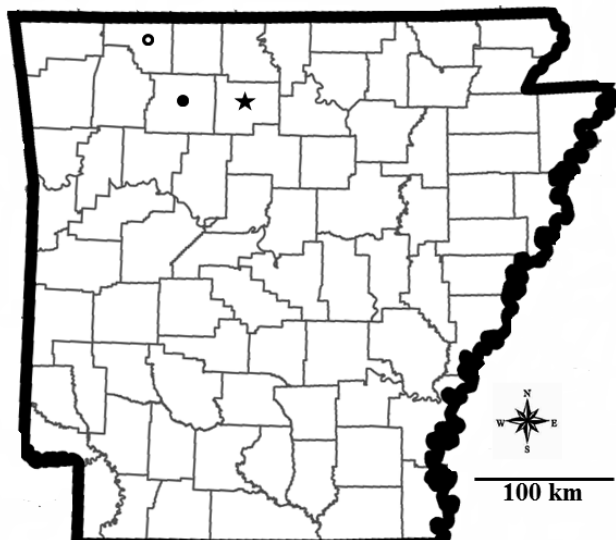


Figure 8. Records of *Nannaria davidcauseyi* (open dot), *N. depalmai* (dot) and *Nannaria* sp. (star) in Arkansas.

Nannaria sp. – **Searcy Co.**, vic. Mull, 3.0 km S jct. St. Hwy. 14/Ramblewood Trail (36.071320°N, 92.582495°W), ♂, 22 Mar. 2011. MBC. NCSM. Two species of *Nannaria* have been previously reported from the state, including *Nannaria davidcauseyi*

Causey from Jasper, Newton Co., and *Nannaria depalmai* (Causey) from Carroll Co. (Hoffman 1999) (Fig. 8). Since those descriptions over 6 decades ago (Causey 1950), no additional *Nannaria* spp., to our knowledge, has been reported from the state although Causey (1955) reported *N. davidcauseyi* from Kentucky. Therefore, the discovery of this additional milliped is especially noteworthy. However, this specimen is likely neither of these 2 species (R. M. Shelley, pers. comm.). Unfortunately, we are unable to provide a specific identity until additional comparative material becomes available.

Polydesmidae

Pseudopolydesmus minor (Bollman). – **Lee Co.**, Bear Creek Recreation Area at Bear Creek Lake (34.704364°N, 90.692482°W), ♂, 21 Nov. 2010. CTM & HWR. NCSM. This narrow, small-bodied specimen is rather distinct from other species known from the state, including *P. pinetorum* and *P. serratus*. It was collected under a rotting oak log and in deciduous forest with abundant canopy on Crowley's Ridge. The type locality is Little Rock, Pulaski Co. (Bollman 1888) and *P. minor* has also been reported previously from McGehee, Desha Co. (Causey 1955) (Fig. 9). Interestingly, its overall range also includes western Tennessee and southern Illinois (Hoffman 1999).

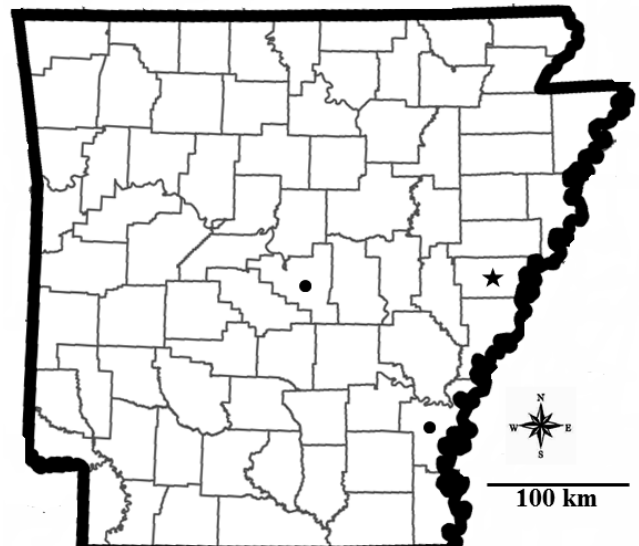


Figure 9. Records of *Pseudopolydesmus minor* in Arkansas. Dots = previous records; star = new record.

Pseudopolydesmus pinetorum (Bollman). – **Arkansas Co.**, Roth Prairie Natural Area (34.435487°N, 91.576030°W), ♂, 22 May 2009. LCT. NCSM. **Clay Co.**, Chalk Bluff Natural Area off co. rd. 368 (34.47809°N, 90.16495°W), ♂, 19 Nov. 2010.

CTM & HWR. NCSM. *Drew Co.*, POW Camp Natural Area, UAM School Forest (33.620144°N, 91.725928°W), ♂♂, 13 Aug. 1992 & 9 Oct. 2009. NCSM. *Greene Co.*, Lake Frierson State Park off Spider Creek Trail (34.042652°N, 90.664261°W), ♂, 26 Feb. 2010, CTM, HWR. NCSM. *Johnson Co.*, Spadra Creek Nature Trail, Clarksville, 31 Mar. 2006, J. Kremers. 4.8 km SW of Oark off St. Hwy. 103, ♂, 3 Apr. 2009, CTM, HWR. NCSM. 11.0 km S of Oark, ♂, 15 Apr. 2011. CTM & HWR. NCSM. *Lee Co.*, Bear Creek Lake Recreation Area at Bear Creek Lake Nature Trail (34.704364°N, 90.692482°W), ♂, 27 Feb. 2012, CTM, HWR. NCSM. *Lincoln Co.*, 5.6 km NE of Cornerville off St. Hwy. 11 (33.837342°N, 91.964493°W), ♂, 11 Nov. 2005, HWR. NCSM. *Pope Co.*, 11.3 km N of Bayou Bluff off St. Hwy. 27 (35.623815°N, 92.875671°W), ♂, 22 Apr. 2010. CTM & HWR. NCSM. *Sevier Co.*, Jefferson Ridge Park, Dierks Lake, ♂, 16 Nov. 2003, CTM. NCSM. *White Co.*, 1.0 km W Center Hill at jct. of Centerville Circle and St. Hwy. 36 (35.259918°N, 91.875916°W), ♂, 9 Apr. 2010. MBC. OMNH. The latter specimen was found in a pocket gopher (*Geomys breviceps*) nest. In addition, 2 of these records (Greene and Lee cos.) are on Crowley's Ridge, where, compared to other parts of the state, few records of millipeds are available. Previous Arkansas records of *P. pinetorum* include 26 cos. (McAllister et al. 2003, their fig. 2). A modern revision of this genus will be necessary to assess the number of valid species and their geographic distribution patterns.

Pseudopolydesmus serratus (Say). – *Nevada Co.*, Arkansas Oak Natural Area (35.201105°N, 91.831833°W), ♂, Oct. 2011. MBC. OMNH. Shelley and Snyder (2012) recently summarized records of *P. serratus* in North America and reported Craighead, Jefferson, Phillips, Poinsett, and Pulaski cos. as previous records in Arkansas. The new record is in the southwestern part of the state in the West Gulf Coastal Plain Province.

Conclusions

In summary, we document 47 new co. records for 19 species in 9 families of millipeds of the state. Undoubtedly, additional records will be reported in the future as several gaps in the distribution of Arkansas millipeds are evident although some authorities consider common species (e.g., *N. americanus*) as ranging statewide, even in the absence of genuine vouchers. Future studies should target sites in eastern Arkansas, including Crowley's Ridge and the Delta,

since little is known about the millipeds of that part of Arkansas. Even though millipeds make up only a small portion of Arkansas' arthropod fauna, the state must strive toward a complete checklist of its flora and fauna to manage its natural resources wisely. Detailed knowledge of such data are desperately needed, if we want to evaluate habitats for land management and conservation, track invasive species, and elucidate global climate change.

Acknowledgments

We thank Dr. R. M. Shelley (NCSM) for confirmation of select specimen identification and Drs. Shelley and K. Menard (OMNH) for expert curatorial assistance. The Arkansas Game and Fish Commission and USDA Forest Service (Ozark District) provided scientific collecting permits to CTM and MBC. We also thank the Arkansas Natural Heritage Commission for allowing LCT to collect on their prairies, and the Marion's for allowing CTM and HWR to collect on their property in Crawford Co. Much appreciation to B. Crump (USDA Forest Service) and J. Kremers (Clarksville) for providing 2 specimens. We dedicate this paper to the memory of Dr. R. Hoffman (1928-2012), milliped expert extraordinaire.

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