An Annotated Checklist of the Millipeds (Arthropoda: Diplopoda) of Oklahoma

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Abstract: Although a great deal of information has been reported over the last two decades on millipeds (Diplopoda) of Oklahoma, no comprehensive surveys have been published, and records of those from the state, particularly those of older records, are scattered throughout the myriapod literature. Here, we provide an annotated checklist of millipeds of Oklahoma reporting 33 species, representing 16 families within eight orders. This contribution is meant to be an initial effort and additional fieldwork will certainly provide new geographic records of additional species in the state.

Introduction

Worldwide, the number of described milliped species has exceeded 12,000 from a global fauna that is estimated, based on known degrees of endemism, to contain around 80,000 species, making the Diplopoda the fourth largest class in the phylum Arthropoda and the most speciose class in the subphylum Myriapoda (Sierwald and Bond 2007). They represent the major component of terrestrial ecosystems throughout the temperate and tropical zones where they constitute a major component of the soil-litter macrofauna. Therefore, knowledge of which species occur geographically is fundamental to conservation and ecological efforts, and documentation of their overall range in various U.S. states.

Early on, studies concerning diplopods were mostly neglected in Oklahoma, and the earliest treatment, primarily restricted to the northeastern part of the state, was documented in the early 1930s through the late 1950s by Ralph Vary Chamberlin (Chamberlin 1931, 1940, 1943) and Nell Bevel Causey (Causey 1950, 1951, 1952, 1954, 1959). One report appeared in the 1960s when Branson (1961) provided records of four species of millipeds from the University of Oklahoma Biological Station (Marshall County). Since then, taxonomy of millipeds has undergone major revisions. For example, main contributions and revisions by William Shear (Shear 1972, 2003, 2010) of members of the Chordeumatida, as well as Rowland Shelley's comprehensive studies and monographs of several major North American milliped groups, including *Pleuroloma* (Shelley 1980), *Auturus* (Shelley 1982), Abacionidae (Shelley 1984), Eurymerodesmidae (Shelley 1990), Polyzoniidae (Shelley 1998), Desmonidae (Shelley 2000b), Parajulidae (Shelley 2000a), *Oriulus* (Shelley 2002), *Brachycybe* (Shelley et al. 2005b), *Scytonotus* (Shelley 2005a), and *Narceus* (Shelley et al. 2006) provided additional records for Oklahoma millipeds.

Interestingly, a significant number of Oklahoma milliped species are known either as troglophiles or troglobites from caves (Shear 1972, 2003, 2010; Graening et al. 2011). For example, Harrel (1960, 1963) reported three milliped taxa from Wild Woman Cave, Murray County, Black (1971) reported records of several millipeds from additional caves of the state, and Lewis (2002) reported on *Chaetaspis* spp. from

Oklahoma caves.

Since the turn of the century, a great deal has been published on the state's millipeds (Lewis 2002; McAllister et al. 2002, 2004, 2005, 2013; McAllister and Shelley 2003, 2005, 2008, 2010; Shear 2003; Shelley et al. 2003, 2005a, 2005b, 2006; McAllister and Robison 2011, 2018; Lewis and Slay 2012; Robison and McAllister 2012; Shelley and Snyder 2012; McAllister and Connior 2016). Although a consolidated listing has never been prepared, we provide an initial list of the millipeds of the state, including a compilation of the milliped literature that cites specific county/state records of specimens from Oklahoma. In addition, this checklist specifically includes records of rarer millipeds from fragile, energy-limited cave environments of the state.

Methods

A review of the milliped literature was undertaken to provide a list of species known to inhabit Oklahoma. The late Richard Lawrence Hoffman, recognized as the world's leading authority of millipeds and his catalogue of North and Middle American Diplopoda (Hoffman 1999), served as a helpful resource although it is now more than two decades old. Another supportive resource was Millibase (http://www.millibase.org), an on-line database which covers the global milliped fauna. In addition, previous collection records by the authors of Oklahoma millipeds as well as continuing collections were used to develop this checklist. Collections were made in preferred shelters of deciduous hardwood forest using a potato rake by turning over decaying logs, moist leaves, rocks, and debris, as well as peeling off bark from trees.

Identification of millipeds were made initially by CTM and confirmed by the late RM Shelley (North Carolina State Museum [NCSM], Raleigh). All recent voucher specimens collected and reported for this project are deposited in the NCSM collection, the Sam Noble Oklahoma Museum of Natural History (SNOMNH), Norman, or the Florida State Collection of Arthropods (FSCA), Gainesville.

The checklist is arranged hierarchically for each taxon starting with the Order Polyxenida, then alphabetically by family and currently accepted scientific name. For each species, county records are provided as well as supplemental notes given as "remarks". Each entry is followed by synonyms and/or new combinations in chronological order. Taxonomy follows Hoffman (1999), Shelley (2003), and Sierwald and Speida (2021).

Results and Discussion

To our knowledge, all known published Oklahoma records are included in this checklist and it documents 33 species, representing 16 families in eight orders as follows:

Class Diplopoda de Blainville in Gervais, 1844
Subclass Chilognatha Latreille, 1802-1803
Order Polyxenida Verhoeff, 1934
Family Polyxenidae Lucas, 1840

***Polyxenus fasciculatus* (Say, 1821) (syn. *Pollyxenus fasciculatus* Say, 1821; *Polyxenus fasciculatus* var. *pallidus* Ryder, 1878).**

Remarks: Say's (1821) original description simply states…"inhabits the southern states." However, according to Bollman (1893)…"its habitat is from Massachusetts to Indian Territory, and it does not seem to be found in the North Central States." Hoffman (1999) noted that this species occurs chiefly on the Coastal Plain from Maryland to Texas, north to Illinois; it is also recorded from Bermuda and the Canary Islands. We therefore tentatively include it herein for Oklahoma although there are apparently no specific locales.

Order Platydesmida Cook, 1895
Family Andrognathidae Cope, 1869

***Brachycybe lecontii* Wood, 1864 (syn. *Platydesmus lecontei* Bollman, 1888; *Brachycybe lecontei* Cook and Loomis, 1928; *Brachycybe lecontii* Gardner, 1975).**

Delaware, Le Flore, McCurtain (Black 1971; McAllister et al. 2002a; Shelley et al. 2005b; Brewer et al. 2012; McAllister and Connior 2016).

Remarks: Black (1971) reported *B. lecontii* from Bear Den Cave (Le Flore County). In their molecular analysis of the genus, Brewer et al. (2012) examined specimens of *B. lecontii* from Le Flore and McCurtain counties; their results had individuals more closely aligned with specimens in branch "LC4" from Arkansas and Missouri, and that they… "represent collectively a genetically divergent lineage." This species is a fungivorous social milliped known for paternal care of eggs and forming multi-generational aggregations (Wong et al. 2020).

Order Julida Brandt, 1833
Family Blaniulidae C. L. Koch, 1847

***Brachyiulus lusitanus* Verhoeff, 1898 (syn. *Brachyiulus* (*Microbrachyiulus*) *pusillus lusitanus* Verhoeff, 1898; *Microbrachyiulus lusitanus* Verhoeff, 1910; *Microbrachyiulus calcivagus* Verhoeff, 1910; *Brachyiulus pusillus* Shelley, 1978).**

Cleveland (McAllister and Robison 2018).

Remarks: This is an introduced species whose native range includes the Caucasus and Mediterranean regions, the Azores, and Canary Islands; it is also introduced in North Carolina and California (Hoffman 1999).

***Nopoiulus kochii* (Gervais, 1847) (syn. *Julus pulchellus* C. L. Koch 1838; *Blaniulus venustus* Meinert, 1868; *Iulus kochii* Gervais, 1847; *Nopoiulus* (*Nopoiulus*) *kochii* Enghoff, 1984).**

Latimer (McAllister and Robison 2018).

Remarks: This is another introduced species widely distributed in both Old (Asia and Europe) and New World localities, including northeastern North America (Nova Scotia, Canada, south to Virginia) and in Washington state (Hoffman 1999; Enghoff and Kime 2005).

***Virgoiulus minutus* (Brandt, 1841) (syn. *Julus pusillus* Say, 1821; *Julus minutus* Brandt, 1841; *Nopoiulus minutus* Brandt, 1841; *Julus sayi* Newport, 1844; *Julus lineatus* McNeill, 1887; *Nopoiulus minutus* Chamberlin, 1922; *Virgoiulus minutus* Enghoff, 1984).**

McCurtain (McAllister et al. 2005).

Remarks: This milliped was found by CTM underneath peeled decaying pine bark in Beaver's Bend State Park (McAllister et al. 2005), which is typical microhabitat of *V. minutus*.

Family Parajulidae Bollman, 1893

***Aliulus caddoensis* Causey, 1950**

Caddo (type locality), Latimer, Le Flore, Murray (new record) (Causey 1950; McAllister and Shelley 2003).

Remarks: Causey (1950) did not provide a specific type locale in Caddo County for the holotype but two additional males were collected from Wilburton, Latimer County. In addition, CTM collected a male, a female, and 11 juveniles as well as two more males of *A. caddoensis* in Caddo County on 8 November 2003 from Cobb State Park and Red Rock Canyon State Park, respectively. Two males collected by CTM on 6 November 2005 from Turner Falls, Murray County, represent a new county record.

***Aniulus (Hakiulus) diversifrons diversifrons* (Wood, 1865) (syn. *Iulus sp.* Wood, 1864; *Iulus diversifrons* Wood, 1867; *Julus diversifrons* Preudhomme de Borre, 1884; *Parajulus castaneus* Bollman, 1887; *Parajulus diversifrons* Bollman, 1893; *Ethoiulus diversifrons* Chamberlin, 1931; *Hakiulus diversifrons* Chamberlin, 1940; *Hakiulus parallelus* Chamberlin, 1940).**

Caddo (new record), Canadian, Cleveland, Coal, Delaware, Hughes, Logan, McCurtain, Murray, Pittsburg (Chamberlin 1940; Causey 1953; Shelley 2000a; McAllister et al. 2013).

Remarks: Chamberlin (1940) described *Hakiulus parallelus* (now a synonym) from at an unspecified location in Cleveland County (Causey 1953; Shelley 2000a). The Caddo County specimen is a new county record collected on 8 November 2003 from Ft. Cobb State Park by CTM. The southeasternmost record for this milliped in the state is McCurtain County (McAllister et al. 2013).

***Okliulus carpenteri* Causey, 1950**

Latimer (type locality).

Remarks: This parajulid was originally described from Wilburton, Latimer County (Causey 1950); there are apparently no other records from the state.

***Oriulus venustus* (Wood, 1864) (syn. *Iulus venustus* Wood, 1864; *Parajulus venustus* Bollman, 1889; *Oriulus grayi* Causey, 1950; *Oriulus venustus* Chamberlin and Hoffman, 1958).**

Marshall, Muskogee, Pittsburg, Pottawatomie (Branson 1961; Shelley 2002).

Remarks: This is the most widespread native milliped species in North America (Shelley and Snyder 2012). This species is found in at least 34 states of the United States, stretching from Massachusetts to Montana, blanketing most of the continental United States in its range.

Order Spirobolida Cook, 1895
Family Spirobolidae Bollman, 1893

***Narceus americanus/annularis* complex (Palisot de Beauvois, 1817) (syn. see Keeton [1960] and Hoffman [1999] for extensive list of synonyms).**

Caddo, Choctaw, Comanche, Craig, Hughes, Le Flore, Marshall, McCurtain, Murray, Okmulgee, Osage, Pittsburg, Pushmataha, Wichita (Chamberlin 1931; Branson 1961; Keeton 1960; McAllister et al. 2002a, 2013; McAllister and Shelley 2003; Shelley et al. 2006).

Remarks: The synonym *Spirobolus oklahomae* Chamberlin, 1931, was synonymized by Keeton (1960) and described by Chamberlin (1931) from Murray County with additional samples from Pushmataha County. It was also reported by Black (1971) from the entrance of Bear Den Cave (Le Flore County). This commonly encountered milliped is found in every U.S. state east of the Mississippi River and nine states to the west (Shelley et al. 2006). The usage of "*Narceus americanus/annularis* complex" to represent species in the genus was recommended by Shelley et al (2006), and the complex is urgently in need of a molecular-based study to help organize the systematics of the group. This widely ranging species-complex contributes about two tons of frass/acre yearly to deciduous forests (Coville 1913).

Order Spirostreptida Brandt, 1833
Family Cambalidae Bollman, 1893

***Cambala minor* Bollman, 1888 (syn. *Cambala annulata* (nec Say, 1821); *Cambala annulata* subsp. *minor* Bollman, 1888; *Cambala minor* Loomis, 1938; *Cambala minor* Loomis, 1943; *Cambala arkansana* Chamberlin, 1942; *Cambala cara* Causey, 1953).**

Adair, Sequoyah (Black 1971; Shelley 1979).

Remarks: This troglophilic milliped has been reported from Three Forks and Cottonwood caves, Adair and Sequoyah counties, respectively (Black 1971; Shelley 1979).

Family Spirostreptidae Brandt, 1833

Orthoporus ornatus* (Girard, 1853) (syn. *Julus ornatus* Girard, 1853; *Spirostreptus montezumae* (nec DeSaussure) Bollman, 1888; *Orthoporus punctilliger* Chamberlin, 1923; *Orthoporus wichitanus* Chamberlin, 1931; *Orthoporus entomacis* Chamberlin and Muliak, 1941; *Orthoporus vallicolens* Chamberlin, 1943; *Orthoporus torreonus* Chamberlin, 1947; *Scaphiostreptus caperanus* Attems, 1950; *Orthoporus crotonus* Chamberlin, 1952; *Orthoporus arizonicus

Loomis, 1953).

Comanche (Chamberlin 1931).

Remarks: The synonym *Orthoporus wichitanus* was described by Chamberlin (1931) from Elk Mountain, Comanche County.

Order Callipodida Pocock, 1894
Family Abacionidae Shelley, 1979

***Abacion tesselatum* Rafinesque, 1820 (syn. *Reasia spinosa* Sager, 1856; *Lisiopetalum eudasym* McNeill, 1887; *Lisiopetalum eudasum* McNeill, 1887; *Lisiopetalum eudasum* McNeill, 1888; *Callipus lactarius* Bollman, 1888; *Lysiopetalium rugulosum* Pocock, 1893; *Lysiopetalum lactarium* Packard, 1883; *Spirostrephon creolum* Chamberlin, 1942; *Platops rugulosa* Newport, 1944; *Spirostrephon lactarium* Johnson, 1954; *Abacion tesselatum tesselatum* Chamberlin and Hoffman, 1958; *Abacion tesselatum creolum* Chamberlin and Hoffman, 1958).**

Craig, Le Flore, McCurtain (Shelley 1984; McAllister et al. 2002a).

Remarks: *Abacion tesselatum* can be differentiated from *A. texense* by possessing a tibiotarsus with only a minute flexure *vs.* a tibiotarsus strongly reflected mediad apically in the latter (Shelley 1984).

***Abacion texense* (Loomis, 1937) (syn. *Lysiopetalum lactarium* Kenyon, 1893; *Spirostrephon texensis* Loomis, 1937; *Spirostrephon texense* Chamberlin, 1942; *Spirostrephon jonesi* Chamberlin, 1942; *Tynomma messicanum* Chamberlin, 1943; *Abacion texense* Chamberlin and Hoffman, 1958).**

Adair, Cherokee, Choctaw, Comanche, Ellis, Garfield, Kiowa, Latimer, Le Flore, Major, Mayes, McCurtain, Okmulgee (new record), Pittsburg, Pottawatomie, Sequoyah, Stephens (Chamberlin 1931; Chamberlin and Hoffman 1958, Loomis 1968; McAllister and Shelley 2010; McAllister et al. 2013).

Remarks: Black (1971) reported *A. texense* from Gittin' Down Mountain Cave (Adair County), Dressler Cave (Cherokee County), and Bear Den Cave (Le Flore County). The specimen collected by CTM on 11 September 2004 from Dripping Springs State Park, Okmulgee County, is a new county record.

Order Chordeumatida Pocock, 1894
Family Cleidogonidae Cook, 1896

***Tiganogona brownae* Chamberlin, 1928**

Murray (McAllister and Shelley 2005)

Remarks: This was only the second report of *T. brownae* since its description and the Murray County specimen collected by CTM is from the Arbuckle Mountains of southcentral Oklahoma, more than 765 km southwest of the type locality at St. Charles, St. Louis County, Missouri (Chamberlin 1928).

Family Trichopetalidae Verhoeff, 1914

***Trichopetalum uncum* Cook and Collins, 1895**

Muskogee (Shear 2010).

Remarks: The single record is a male from Dresser Cave, 8.0 km N of Ft. Gibson, Muskogee County (Shear 2010).

***Trigenotyla blacki* Shear, 2003**

Adair, Delaware (type locality) (Black 1971; Shear 2003; Robison and McAllister 2012).

Remarks: All specimens of the endemic *T. blacki* are from either Delaware County caves, including Bell's Bluff, Jail House, Stansbury-January, and Twin caves, or Cave #AD-14 (Adair County) (Shear 2003). It is considered the only true troglobitic milliped known from Oklahoma.

***Trigenotyla seminole* Shear, 2003**

Seminole (Black 1971; Shear 2003; Robison

and McAllister 2012).

Remarks: The holotype was collected from Whiskey Cave, Seminole County; others were from Doolin and Cold Springs caves in same county (Shear 2003). It is an endemic species in the state (Robison and McAllister 2012).

***Trigenotyla vaga* Causey, 1959**

Johnston, Latimer (type locality), Le Flore, Murray (Causey 1959; Black 1971; Shear 2003; McAllister and Shelley 2003; Robison and McAllister 2012).

Remarks: The type specimen was described from a "river ravine" in Latimer County (Causey 1959), so it is impossible to know the exact type locality. Additional specimens have been reported from Wild Women Cave, Murray County (Shear 2003). It is another Oklahoma endemic milliped species (Robison and McAllister 2012).

Order Polydesmida Pocock, 1887

Family Sphaeriodesmidae

***Desmonus pudicus* (Bollman, 1888) (syn. *Sphaeriodesmus pudicus* Bollman, 1888; *Desmonus pudicus* Cook, 1898; *Ethocyclus atophus* Chamberlin and Mulaik, 1941; *Desmoniella curta* Loomis, 1943; *Desmonus inordinatus* Causey, 1958; *Desmonus austrus* Causey, 1958: *Desmonus conjunctus* Loomis, 1959; *Desmonus crassus* Loomis, 1959; *Desmonus distinctus* Loomis, 1959; *Desmonus atophus* Loomis, 1959; *Stilbopagus acclivus* Loomis, 1966; *Tetraporosoma seriata* Loomis, 1966).**

Pontotoc (Shelley 2000b).

Remarks: Six females and two juveniles were collected in the Arbuckle Mountains, 3.7 km S Pittstown, Pontotoc County; these were initially described by Loomis (1943, his fig. 3) as *Desmoniella curta* (see Shelley 2000b). Although there are several records from the surrounding states of Arkansas, Louisiana, Missouri, and Texas (Shelley 2000b, his fig. 17), none, to our knowledge, have been collected since that time in Oklahoma.

Family Trichopolydesmidae Verhoeff, 1910

Remarks: The *Chaetaspis* spp. below was formally included in the family Macrosternodesmidae Brölemann, 1916, which was recently classified by Golovatch (2013) as a synonym of the Trichopolydesmidae. However, Shear and Reddell (2017) do not agree, and as they say…"since this family, almost completely endemic to North America, seems to us to be clearly diagnosable and distinct." For the time being, we follow Golovatch (2013) until more conclusive evidence is provided to the contrary.

***Chaetaspis* sp. (undescribed)**

Murray (Harrell 1960; Black 1971; Lewis 2002)

Remarks: This undescribed troglobitic species was originally collected by R.C. Harrell. He (Harrell 1960) reported it a new species of *Chaetaspis* (as *Antriadesmus*) from Wild Woman Cave that was being studied by N. Causey. Lewis (2002) reported this milliped as *Chaetaspis* undescribed species 2 from Murray County, 427 m into the dark zone of an unspecified cave.

***Chaetaspis* sp. (undescribed)**

Cherokee (Lewis and Slay 2012).

Remarks: Lewis and Slay (2012, their fig. 6) reported this milliped as *Chaetaspis* n. sp. 2. It is yet to be named and formally described and there are surely others in the genus that inhabit subterranean habitat in the state (see Graening et al. 2011).

Family Xystodesmidae Cook, 1895

Remarks: A recent study (Shelley and Smith 2018) subsumed the families Eurymerodesmidae and Euryuridae under Xystodesmidae; this higher-level change was justified based solely on similarity of male genitalic morphology.

***Apheloria virginiensis reducta* Chamberlin, 1931 (syn. *Apheloria reducta* Chamberlin, 1939)**

McCurtain (Causey 1954; McAllister et al. 2003a; Shelley and McAllister 2007).

Remarks: Causey (1954) was the first to report *A. reducta* from Oklahoma from an unspecified locality in McCurtain County; it is known from Beaver's Bend State Park, McCurtain County (McAllister et al. 2002). This xystodesmid is known to possess the aroma of benzaldehyde (similar to maraschino cherries) and squirt mandelonitrile (a cyanogen) and hydrogen cyanide from pores lining the sides of its body as a chemical defense, so care should be taken when collecting.

***Auturus louisianus louisianus* (Chamberlin, 1918) (syn. *Euryurus louisiana* Chamberlin, 1918; *Auturus louisiana* Causey, 1955; *Auturus louisianus louisianus* Shelley, 1982).**

Latimer, Le Flore, McCurtain (Shelley 1982; McAllister et al (2002, 2003).

Remarks: Hoffman (1999), in error, stated the range included southwestern Oklahoma but it is actually southeastern Oklahoma.

***Auturus evides* (Bollman, 1887) (syn. *Paradesmus evides* Bollman, 1887; *Auturus mimetes* Chamberlin, 1942; *Auturus florus* Causey, 1950; *Auturus evides* Shelley, 1982).**

Adair, Cherokee, Mayes, Sequoyah, Wagoner (Black 1971; Shelley 1982).

Remarks: Black (1971) reported *A. evides* from Ft. Gibson Cave no. 4 (Wagoner County).

***Eurymerodesmus birdi birdi* Chamberlin, 1931 (syn. *Leptodesmus hispidipes* Gunthorp, 1913; *Eurymerodesmus birdi* Chamberlin, 1931; *Eurymerodesmus creolus* Chamberlin, 1942; *Eurymerodesmus schmidti* Chamberlin, 1943; *Eurymerodesmus plishneri* Causey, 1950).**

Cherokee, Cleveland (new record), Garvin, Hughes, Le Flore, McCurtain, Murray (type locality), Payne, Pittsburg, Pottawatomie, Seminole, Wagoner (Chamberlin 1931; Causey 1952; Chamberlin and Hoffman 1958; Branson 1961; Black 1971; Shelley 1990; McAllister et al. 2002, 2003).

Remarks: Shelley (1990) examined several specimens from Oklahoma and noted that habitat data was given on vial labels for those individuals from counties as follows: Cherokee (Dressler Cave), Garvin (on patio), Le Flore (Bear Den Cave), Payne (on driveway), Seminole (Whiskey Cave), and Wagoner (under rocks in woods). The Cleveland County specimen is a new county record collected by CTM on 7 November 2003 at Lake Thunderbird State Park.

***Eurymerodesmus digitatus* Loomis, 1976**

Comanche (Shelley 1990)

Remarks: Thus far only known from a single site in the state, three male specimens collected at Mt. Scott in October 1974 (see Shelley 1990).

***Eurymerodesmus dubuis* Chamberlin, 1943 (syn. *Paresmus columbus* Causey, 1950).**

Choctaw, McCurtain (McAllister et al. 2002)

Remarks: To date, only reported from two counties in the southeastern part of the state.

***Eurymerodesmus mundus* Chamberlin, 1931 (syn. *Leptodesmus floridus* Kenyon, 1893; *Leptodesmus hispidipes* Gunthorp, 1913; *Eurymerodesmus mundus* Chamberlin, 1931).**

Caddo, Canadian, Cleveland (type locality), Comanche, Craig, Grady, Latimer, Le Flore, Logan, McClain, McCurtain, Latimer, Noble, Osage, Pittsburg, Pushmataha, Tulsa, Washita, Woodward (Chamberlin 1931; Chamberlin and Hoffman 1958; Shelley 1990; McAllister et al. 2004, 2013; McAllister and Shelley 2008; McAllister and Robison 2011.

Remarks: Shelley (1990) reported that size varies greatly between specimens of *E. mundus* and those from Oklahoma are among the largest. In addition, the holotype was collected by RD Bird from blackjack oak (*Quercus marilandica*) litter at or very near the University of Oklahoma campus at Norman (Chamberlin 1931). This milliped is known from at least 19 Oklahoma counties, with Washita County being the westernmost distribution in the state.

***Pleuroloma flavipes* Rafinesque, 1820 (syn. see Shelley [1980], and Marek et al. [2012] who lists no less than 28 synonyms).**

Adair, Cherokee, Latimer, Mayes, McIntosh, Noble, Nowata, Payne, Pittsburg, Rogers, Sequoyah, Tulsa, Wagoner (Causey 1951; Shelley 1980; Shelley et al. 2003).

Remarks: Causey (1951) reported the synonym *Zinaria warreni* from Latimer County. In addition, Black (1971) reported this species as *Pleuroloma brunnea*, another synonym, from Christian School Study, Three Forks, and Gittin' Down caves, Adair County. The species has the most extensive distribution of any known xystodesmid (Shelley 1980).

Family Paradoxosomatidae Daday, 1889

***Oxidus gracilis* (Koch, 1847) (syn. *Fontaria gracilis* C. L. Koch, 1847; *Paradesmus dasys* Bollman, 1887; *Orthomorpha gracilis* Bollman, 1893; *Orthomorpha dasys* Bollman, 1893).**

Bryan, Caddo (new record), Comanche, Marshall, Tulsa (McAllister and Robison 2018).

Remarks: The introduced "hothouse" milliped is ubiquitous in the lower 48 states and could be expected in any Oklahoma county. Specimens were collected by CTM from Red Rock Canyon State Park, Caddo County on 8 November 2003.

Family Polydesmidae Leach, 1815

***Pseudopolydesmus pinetorum* (Bollman, 1888) (syn. *Polydesmus pinetorum* Bollman, 1888; *Polydesmus americanus* Carl, 1902; *Polydesmus pinetorum* Chamberlin, 1943; *Polydesmus modocus* Chamberlin, 1943; *Pseudopolydesmus hubrichti* [Chamberlin, 1943])**

Adair, Atoka, Caddo, Choctaw, Cleveland, Delaware, Johnston, Latimer, Le Flore, Logan, Marshall, McCurtain, McIntosh, Murray, Osage, Payne, Pittsburg, Pontotoc, Woodward (Chamberlin 1931; Causey 1953; Harrel 1960, 1963; Black 1971; Withrow 1988; McAllister et al. 2002, 2013).

Remarks: Chamberlin (1943) described *Polydesmus hubrichti*, a synonym of *P. pinetorum* from Latimer and Murray counties. Black (1971) reported *P. pinetorum* from Stansberry-January Cave (Delaware County), HorseThief Cave no. 2 (Johnston County), and Wild Woman Cave (Murray County). Throughout its range, this milliped is most commonly collected west of the Mississippi River (Sierwald et al. 2019).

Family Scytonotidae Cook and Loomis, 1924

***Scytonotus granulatus* (Say, 1821) (syn. *Scytonotus laevicollis* C. L. Koch, 1847; *Scytonotus scabricollis* C. L. Koch, 1847; *Stenonia hispida* Sager, 1856; *Polydesmus setiger* Wood, 1865; *Scytonotus cavernarum* Bollman, 1887; *Scytonotus granulatus* Bollman, 1887).**

Latimer, Le Flore (Shelley et al. 2005a)

Remarks: The exact locale of *S. granulatus* in Latimer County is unknown (Shelley et al. 2005a). The specimen from the Choctaw Nation State Historic site in Le Flore County represents a westward range expansion of at least 405 km from sites in Arkansas (Shelley et al. 2005a).

The following millipeds have not yet been reported from Oklahoma but are found in adjacent states and are possible in the state according to the following authors:

Order Julida

Family Parajulidae

***Gosiulus conformatus* Chamberlin, 1940**

Remarks: Shelley and Smith (2018) reported it was plausible that *G. conformatus* occurs north of the Red River in southern Oklahoma and conceivably even in western Kansas.

Order Chordeumatida
Family Cleidogonidae

***Causeyella* sp.**

Remarks: Shear (2003) erected the genus *Causeyella* based on *Scoterpes dendropus* Loomis, 1939 from Missouri and described two additional species, C. *youngsteadtorum* and *C. causeyae* in adjacent Arkansas**.** He (Shear 2003) does not provide any county records for this genus in the state. However, Graening et al. (2011, their Table 4.3) list this genus as occurring in Oklahoma without providing any records and/or voucher specimens. It is possible this cave adapted species may eventually be found in caves of northeastern Oklahoma.

Family Trichopetalidae

***Trigenotyla parca* Causey, 1951**

Remarks: Shear (2003) mentions that "*T. parca*….probably also occur in adjoining Oklahoma."

Order Callipodida
Family Abacionidae

***Abacion wilhelminae* Shelley, McAllister, and Hollis, 2003**

Remarks: This Critically Imperiled (S1) species is so far only known from a single site on Rich Mountain, Polk County, Arkansas (Shelley et al. 2003; NatureServe 2021). Additional collecting efforts by CTM and colleagues failed to find *A. wilhelminae* at other similar locales on the mountain. However, as the same Ouachita uplift extends further westward into Oklahoma, it may eventually be found there with future collections.

Order Polydesmida
Family Polydesmidae

***Pseudopolydesmus serratus* (Say, 1821)**

Remarks: Shelley and Snyder (2012, their fig. 4) show its peripheral range includes most of central and eastern Oklahoma without giving any specific records; the closest record is Barber County, Kansas, just over the border on the northern edge of the state. In addition, Sierwald et al. (2019) does not mention any Oklahoma records in their taxonomic synthesis of the genus. Therefore, it is conceivable this species occurs in the state where little collecting has been done in counties south of the Kansas line.

Our checklist includes a total of 33 milliped species within 24 genera, 16 families, and eight orders to inhabit 51 (66%) of Oklahoma's 77 counties. The three most speciose milliped families from the state are the Xystodesmidae, which represents 24% (eight species) of the described Oklahoma fauna, followed by Trichopeltidae (12%) and Parajulidae (12%), each with four species. The largest represented genera are *Eurymerodesmus* which represents (12%) of the state's fauna with four species, *Trigenotyla* (9%) with three species, and *Auturus* and *Abacion* (6%) with two species, each. Only 6% of the described Oklahoma fauna is non-native.

To date, the majority of Oklahoma millipeds have been reported from counties of the oak-hickory-pine Ouachita Highlands of the southeastern corner (Fig. 1), including McCurtain (12 species) and Latimer and Le Flore, each with 11 species. The central and eastern part of Oklahoma supports the majority of milliped biodiversity in the state; the only counties in far eastern Oklahoma without any records are Haskell and Ottawa (Fig. 1). Comparatively speaking, the western and southwestern regions have fewer records of millipeds. Furthermore, there are no current records of millipeds in any of the three counties (Beaver, Cimarron, and Texas) making up the Panhandle of Oklahoma. This might be explained possibly by a combination of two factors: (1) fewer milliped surveys have been conducted in those regions, and (2)

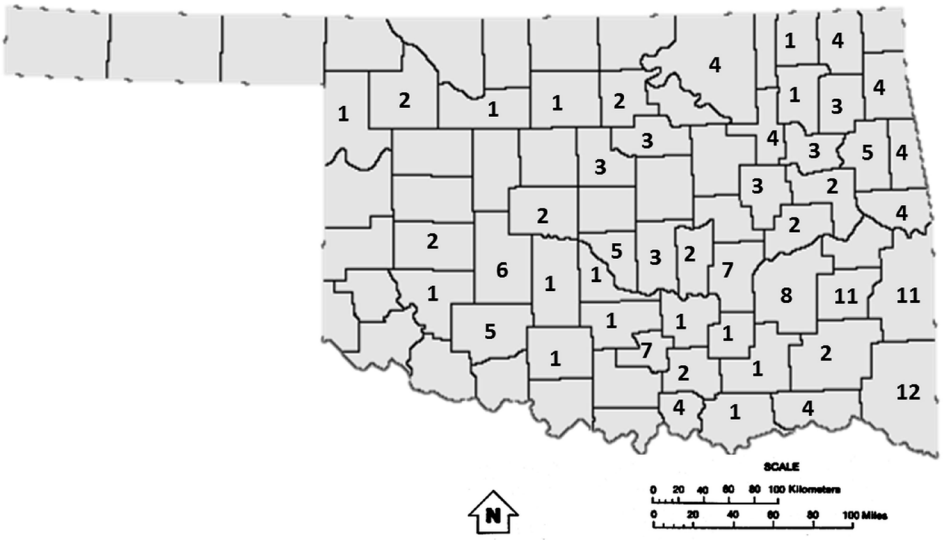

Figure 1. Number of milliped species within each Oklahoma county.

compared to eastern Oklahoma, the region has a harsher climate, less precipitation, and sparser vegetation in the Pinon-Juniper Mesas and Shortgrass Plains physiognomic regions (see Caire et al. 1989).

Given the paucity of information about the taxonomy/systematics, distribution, ecology, and natural history of millipeds in Oklahoma, there are sufficient opportunities to add to this growing body of knowledge by intensive collecting and further biological studies of these invertebrates. In addition to routine collecting techniques noted herein, sifting dead leaves, use of Berlese funnel extraction, and using pitfall traps is recommended. Deposition of voucher specimens is a must and collectors should make every effort to preserve specimens in DNA grade ethanol, 10% neutral-buffered formalin (for scanning electron microscopy of gonopods), and accession them into a publically accessible museum collection. We also suggest that future surveys should target sites with accessible trails in the western part of the state and Panhandle, where virtually nothing is known to date about millipeds and their distributional patterns in those regions.

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References

Black JH. 1971. The cave life of Oklahoma: A preliminary study (excluding Chiroptera). Okla Undergr 4:2–56.

Bollman CH. 1893. Notes upon the species of Myriapoda described by Thomas Say. Bull US Natl Mus No. 46:144–149.

Branson BA. 1961. Notes on and records of some invertebrates collected in Oklahoma. Proc Okla Acad Sci 42:81–86.

Brewer M, Sierwald P, Bond J. 2012. Millipede taxonomy after 250 years: classification and taxonomic practices in a mega-diverse yet understudied arthropod group. PLoS ONE 7:e37240.

Caire W, Tyler TJ, Glass BP, Mares MA. 1989. Mammals of Oklahoma. Norman (OK): University of Oklahoma Press. 567 p.

Causey NB. 1950. New genera and species or millipeds-Paraiulidae (Juloidea). Proc Ark Acad Sci 3:45–52.

Causey NB. 1951. The milliped assembly *Zinaria butlerii* isogen (Xystodesmidae). Proc Ark Acad Sci 4:73–88.

Causey NB. 1952. On three eurymerodesmid millipeds and notes on *Paresmus impurus* (Wood). Ent News 63:169–176.

Causey NB. 1953. On five new North American millipeds and records of some established species. Amer Midl Nat 50:152–158.

Causey NB. 1954. Three new species and new records of southern millipeds. Tulane Stud Zool 2:61–68.

Causey NB. 1959. A second species of the milliped genus *Trigenotyla* (Chordeumidea: Conotylidae: Trichopetalinae: Scoterpini). Proc Biol Soc Wash 72:75–77.

Chamberlin RV. 1928. Some chilopods and diplopods from Missouri. Ent News 39:153–155.

Chamberlin RV. 1931. On a collection of chilopods and diplopods from Oklahoma. Ent News 42:97–105.

Chamberlin RV. 1940. New genera and species of North American Paraiulidae. Bull Univ Utah, Biol Ser 5:1–39.

Chamberlin RV. 1943. A new *Polydesmus* from Missouri and Oklahoma. Ent News 54:15–16.

Chamberlin RV, Hoffman RL. 1958. Checklist of the millipeds of North America. US Natl Mus Bull 212:1–236.

Coville FV. 1913. The formation of leafmold. J Wash Acad Sci 3:77–89.

Enghoff H, Kime RD (ed.). 2005. Myriapoda [online]. Fauna Europaea version 1.2. Available from: http://www.faunaeur.org in (Accessed October 1, 2021)

Graening GO, Fenolio DB, Slay ME. 2011. Cave life of Oklahoma and Arkansas: Exploration and conservation of subterranean biodiversity. Norman (OK): University of Oklahoma Press. 226 p.

Golovatch SI. 2013. A reclassification of the millipede superfamily Trichopolydesmoidea, with descriptions of two new species from the Aegean region (Diplopoda, Polydesmida). ZooKeys 340:63–78.

Harrell R. 1960. A preliminary report on the invertebrate animals of Wild Woman Cave, Murray County, Oklahoma. Proc Okla Acad Sci 40:29–34.

Harrel R. 1963. Further notes on invertebrate animals of Wild Woman Cave, Murray County, Oklahoma. Proc Okla Acad Sci 43:129–131.

Hoffman RL. 1999. Checklist of millipeds of North and Middle America. Virginia Mus Nat Hist Spec Publ No. 8:1–584.

Keeton WT. 1960. A taxonomic study of the milliped family Spirobolidae (Diplopoda: Spirobolida). Mem Amer Entomol Soc 17:1–146.

Lewis JJ. 2002. *Chaetaspis aleyorum*, a new species of millipede from Tumbling Creek Cave, Missouri, with a synopsis of the cavernicolous species of *Chaetaspis* (Diplopoda: Polydesmida). Myriapodologica 7:101–111.

Lewis JJ, Slay ME. 2012. *Chaetaspis attenuatus*, a new species of cavernicolous milliped from Arkansas (Diplopoda: Polydesmida: Macrosternodesmidae). J Cave Karst Stud 75:60–63.

Loomis HF. 1943. New cave and epigean millipeds. Bull Mus Comp Zool 92:373–410.

Loomis HF. 1968. A checklist of the millipeds of Mexico and Central America. US Natl Mus Bull No. 266:1–136.

Marek P, Tanabe T, Sierwald P. 2012. A species catalog of the millipede family Xystodesmidae (Diplopoda: Polydesmida). Virginia Mus Nat Hist Publ 17:1–117.

McAllister CT, Connior MB. 2016. A new geographic record for *Brachycybe lecontii* (Diplopoda: Platydesmida: Andrognathidae) from Oklahoma. Proc Okla Acad Sci 96:42–45.

McAllister CT, Robison HW. 2011. Millipeds (Arthropoda: Diplopoda) of the Ark-La-Tex. V. New distribution records for select taxa in Arkansas, Oklahoma, and Texas. Southwest Nat 56:422–426.

McAllister CT, Robison HW. 2018. Introduced millipeds (Arthropoda: Diplopoda) of Arkansas, Louisiana, Oklahoma, and Texas. Southwest Nat 63:284–289.

McAllister CT, Robison HW, Connior MB. 2013. New geographic distribution records for millipeds (Diplopoda) from Oklahoma. Proc Okla Acad Sci 93:7–12.

McAllister CT, Shelley RM. 2003. Millipeds (Arthropoda: Diplopoda) of the Ark-La-Tex. IV. New geographic distribution records from southcentral and southeastern Oklahoma. J Ark Acad Sci 57:115–121.

McAllister CT, Shelley RM. 2005. Discovery of the milliped, *Tiganogona brownae* Chamberlin (Diplopoda: Chordeumatida: Cleidogonidae) in central Oklahoma: Westernmost records for the family and genus. Proc Okla Acad Sci 85:79–80.

McAllister CT, Shelley RM. 2008. New records of eurymerodesmid millipeds (Diplopoda: Polydesmida) from Arkansas, Kansas, Louisiana, Oklahoma, and Texas. J Ark Acad Sci 62:155–158.

McAllister CT, Shelley RM. 2010. Distribution of *Abacion texense* (Loomis, 1937), the only milliped species traversing the Rio Grande, Mississippi, and Pecos rivers (Callipodida: Abacionidae). Insecta Mund 0124:1–8.

McAllister CT, Shelley RM, Enghoff H, Ramsey ZD. 2005. Distribution of the milliped *Virgoiulus minutus* (Brandt, 1841): First records from Mississippi, Oklahoma, and Texas (Julida: Blaniulidae). West North Amer Nat. 65:258–266.

McAllister CT, Shelley RM, McAllister JT III. 2002. Millipeds (Arthropoda: Diplopoda) of the Ark-La-Tex. II. Distributional records for some species of western and central Arkansas and eastern and southeastern Oklahoma. J Ark Acad Sci 56:95–98.

McAllister CT, Shelley RM, Moore DI. 2004. Noteworthy records of the millipeds, *Eurymerodesmus angularis* and *E. mundus* (Polydesmida: Eurymerodesmidae), from northeastern and westcentral Texas. Tex J Sci 56:73–77.

NatureServe. 2021. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. Available from: https://explorer.natureserve.org/. (Accessed: October 29, 2021).

Robison HW, McAllister CT. 2012. The endemic biota of Oklahoma. Proc Okla Acad Sci 92:21–28.

Say T. 1821. Descriptions of the Myriapodae of the United States. J Acad. Nat. Sci. Philadelphia 2 (Part 1):102–114.

Shear WA. 1972. Studies in the milliped order Chordeumatida (Diplopoda): A revision of the family Cleidogonidae and a reclassification of the order Chordeumida in the New World. Bull Mus Comp Zool 144:151–352.

Shear WA. 2003. The milliped family Trichopetalidae, Part 1: Introduction and genera *Trigenotyla* Causey, *Nannopetalum* n. gen., and *Causeyella* n. gen. (Diplopoda: Chordeumatida, Cleidogonoidea). Zootaxa 0321:1–36.

Shear WA. 2010. The milliped family Trichopetalidae, Part 2: The genera *Trichopetalum*, *Zygonopus* and *Scoterpes* (Chordeumatida, Cleidogonoidea). Zootaxa 2385:1–62.

Shear WA, Reddell JM. 2017. Cave millipedes of the United States. XIV. Revalidation of the genus *Speorthus* Chamberlin, 1952 (Diplopoda, Polydesmida, Macrosternodesmidae), with a description of a new species from Texas and remarks on the families Polydesmidae and Macrosternodesmidae in North America Insecta Mundi 0529:1–13.

Shelley RM. 1979. A synopsis of the milliped genus *Cambala*, with a description of *C. minor* Bollman (Spirostreptida: Cambalidae). Proc Biol Soc Wash 92:551–571.

Shelley RM. 1980. Revision of the milliped genus *Pleuroloma* (Polydesmida: Xystodesmidae). Can J Zool 58:129–168.

Shelley RM. 1982. Revision of the milliped genus *Auturus* (Polydesmida: Platyrhacidae). Can J Zool 60:3249–3267.

Shelley RM. 1984. A synopsis of the milliped genus *Abacion* Rafinesque (Callipodida: Caspiopetalidae). Can J Zool 62:980–988.

Shelley RM. 1990 (1989). Revision of the milliped family Eurymerodesmidae (Polydesmida: Chelodesmidea). Mem Amer Entomol Soc 37:1–112.

Shelley RM. 1998. The milliped family Polyzoniidae in North America, with a classification of the global fauna (Diplopoda Polyzoniida). Arthrop Sel 6:3–34.

Shelley RM. 2000a. Parajulid studies II. The subgenus *Hakiulus* Chamberlin (Julida: Parajulidae: Parajulinae: Aniulini). Myriapodologica 6:121–145.

Shelley, R. M. 2000b. Revision of the milliped subfamily Desmoninae (Polydesmida: Sphaeriodesmidae). Myriapodologica 6:27–54.

Shelley RM. 2002. The milliped genus *Oriulus* Chamberlin (Julida: Parajulidae). Can J Zool 80:100–109.

Shelley RM. 2003. A revised, annotated, family-level classification of the Diplopoda. Arthr Select 11:187–207.

Shelley RM, McAllister CT. 2007. Distribution of the milliped genus *Apheloria* Chamberlin, 1921; summaries of peripheral localities and ones of *A. virginiensis* (Drury, 1770) west of the Mississippi River (Polydesmida: Xystodesmidae). West North Amer Nat 67:258–269.

Shelley RM, McAllister CT, Hollis JL. 2003. A new milliped of the genus *Abacion* Rafinesque, 1820 from Arkansas, U. S. A. (Callipodida: Abacionidae). Zootaxa 170:1–7.

Shelley RM, McAllister CT, Medrano MF. 2006. Distribution of the milliped genus *Narceus* Rafinesque, 1820 (Spirobolida: Spirobolidae): occurrences in New England and west of the Mississippi River: a summary of peripheral localities; and first records from Connecticut, Delaware, Maine, and Minnesota. West North Amer. Nat. 66:374–389.

Shelley RM, McAllister CT, Ramsey ZD. 2005a. Discovery of the milliped *Scytonotus granulatus* (Say, 1821) in Oklahoma and Alabama, with a review of its distribution (Polydesmida: Polydesmidae). West North Amer Nat 65:112–117.

Shelley RM, McAllister CT, Smith SB. 2003. Discovery of the milliped *Pleuroloma flavipes* (Polydesmida: Xystodesmidae) in Texas, and other records from west of the Mississippi River. Ent News 114:2–6.

Shelley RM, McAllister CT, Tanabe T. 2005b. A synopsis of the milliped genus *Brachycybe* Wood, 1864 (Platydesmida: Androgonathidae). Frag Faun 48:137–166.

Shelley RM, Smith JM. 2018. Expanded concept and revised taxonomy of the milliped family Xystodesmidae Cook, 1895 (Polydesmida: Leptodesmidea: Xystodesmoidea): incorporations of Euryuridae Pocock, 1909 and Eurymerodesmidae Causey, 1951, taxon revivals/proposals/transferrals, and a distributional update. Insecta Mund 0660:1–41.

Shelley RM, Snyder BA. 2012. Millipeds of the eastern Dakotas and western Minnesota, USA, with an account of *Pseudopolydesmus serratus* (Say, 1821) (Polydesmida: Polydesmidae); first published records from six states and the District of Columbia. Insecta Mund 0239:1–17.

Sierwald P, Bond JE. 2007. Current status of the Myriapod class Diplopoda (millipedes): Taxonomic diversity and phylogeny. Ann Rev Entomol 52:401–420.

Sierwald P, Hennen DA, Zahnle XJ, Ware S, Marek PE. 2019. Taxonomic synthesis of the eastern North American millipede genus *Pseudopolydesmus* (Diplopoda: Polydesmida: Polydesmidae), utilizing high-detail ultraviolet fluorescence imaging. Zool J Linn Soc 187:1–26.

Sierwald P, Spelda J. 2021. MilliBase [online]. Available from: http://www.millibase.org. (Accessed October 1, 2021).

Withrow CP. 1988. Revision of the genus *Pseudopolydesmus* Attems, 1898, and its relationships to the North American genera of the family Polydesmidae Leach [PhD thesis]. Columbus (OH): The Ohio State University. 297 p. Available from Ohio State University Library.

Wong VL, Hennen DA, Macias AM, Brewer MS, Kasson MK, Marek PE. 2020. Natural history of the social millipede *Brachycybe lecontii* Wood, 1864. Biodiversity Data Journal 8:e50770.

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