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New Geographic Distribution Records for Horsehair Worms (Nematomorpha: Gordiida) in Arkansas, Including New State Records for *Chordodes morgani* and *Paragordius varius*

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Juvenile horsehair (gordiid) worms (Nematomorpha) are obligate parasites of terrestrial arthropods (often crickets and beetles) and, as adults, are free-living in freshwater sites including lakes, streams, and rivers. They are cosmopolitan in distribution with about 18 species reported from North America (Schmidt–Rhaesa et al. 2003, Poinar and Chandler 2004, Poinar et al. 2004). Compared to other animal phyla, until recently (see Hanelt et al. 2005, Looney et al. 2012), gordiids have received relatively little attention.

The first report of a horsehair worm from Arkansas was of *Gordius robustus* Leidy, 1851 by Montgomery (1907). Unfortunately, no specific locality data was provided. McDaniel and Smith (1976) reported undetermined gordiids from caves in IZard and Stone counties of the state. In addition, Huggins and Harp (1983) reported a *Paragordius* sp. during a general survey on aquatic macroinvertebrates from the Hiatt Prairie region of northwestern Arkansas, but provided no specific identification. Others have done likewise, including Cochran and Harp (1990), who reported *Gordius* sp. and *Paragordius* sp. from the St. Francis Sunken Lands of northeastern Arkansas, and Chordas et al. (1996) reported *Paragordius* sp. from the White River National Wildlife Refuge. To our knowledge, the only other report of horsehair worms from the state was by Harp and Robison (2006), who reported unidentified gordiids from the Strawberry River system of northcentral Arkansas. Herein we document the first report of 2 species of gordiid worms from the state as well as new county distributional records for those of the *Gordius* sp. “complex.”

Between March 1980 and November 2006, collections of freshwater (free-living) horsehair worms were made in 14 counties of Arkansas, including Craighead, Columbia, Franklin, Howard, Independence, Lincoln, Monroe, Montgomery,

Poinsett, Pulaski, Randolph, Sharp, Stone, and White. Specimens were collected by hand and/or aquatic dipnet and placed in vials of 70% ethanol or isopropyl alcohol. Most were identified and deposited originally in the G. L. Harp Macroinvertebrate Collection at Arkansas State University (ASUMZ) or teaching collections at Harding University. Recently, we were able to re-examine these specimens and verify their original identifications. Voucher specimens have been transferred to the University of New Mexico Museum of Southwestern Biology (MSB), Parasite Division, Albuquerque, New Mexico (MSB: PARA: 1177–1202).

The posterior end of each worm was examined for species-level characters. In addition, from each specimen, a cuticle preparation was made for study by light microscopy. A 0.5mm section was taken from the worm’s midsection and the underlying tissue was removed using a razor blade. The cuticle was placed onto a slide with 70% ethanol ensuring that part of the cuticle was folded under to allow for investigation of cuticular structures from a lateral view. Worms were identified by their posterior and cuticle structures based on a key and photomicrographs provided by Schmidt–Rhaesa et al. (2003).

On further examination, specimens were identified as *Chordodes morgani* Montgomery, 1898, *Paragordius varius* (Leidy, 1851), and *Gordius* sp. “complex.” This is the first time *C. morgani* has been reported from Arkansas as well as the first report of *P. varius* being definitively reported from the state. In addition, we report new geographic distribution (county) records in Arkansas for horsehair worms of the *Gordius* sp. “complex”.

Gordioid species (Fig. 1) are presented along with their distributional information (county, specific locality, collection date, collector, sex [if known], remarks).

Annotated List of Species

Chordodes morgani Montgomery, 1898.—**Monroe Co.**, Indian Bayou at St. Hwy 1 bridge, 30 June 1990, S. W. Chordas, III, ♂. First report from the state (Fig. 1); apparently misidentified as *Paragordius* sp. (see Chordas et al. 1996). *Chordodes morgani* has previously been reported from 15 states, including Florida, Iowa, Indiana, Kentucky, Maryland, Michigan, Missouri, Nebraska, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Texas, and Wisconsin, but none of the Canadian Provinces (Schmidt–Rhaesa et al. 2003).

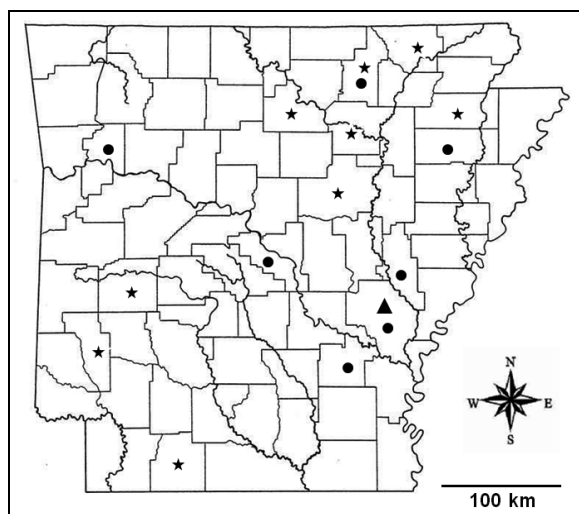


Figure 1. County distribution of gordiids in Arkansas. Symbols: triangle (*Chordodes morgani*), dots (*Paragordius varius*), stars (*Gordius* sp. “complex”).

Paragordius varius (Leidy, 1851).—**Arkansas Co.**, White River reservoir, 11 Aug. 1990, S. W. Chordas, III, ♂; Escrogens Lake, White River National Wildlife Refuge, 21 Aug. 1990, S. W. Chordas, III, ♂. **Franklin Co.**, Hiatt Creek, 11 Oct. 1980, J. Huggins, ♂. **Lincoln Co.**, Arkansas River at Lock and Dam No. 3, Huff’s Island Use Area, 1 Sept. 1986, G. L. & P. A. Harp, ♂. **Monroe Co.**, Indian Bayou at St. Hwy 1 bridge, 2 July 1986, G. L. & P. A. Harp, ♀. **Poinsett Co.**, Steven’s Landing, St. Francis River, 17 Oct. 1987, B. Crump, ♂; Snowden’s Field Bridge, St. Francis River, 17 Oct. 1987, B. Crump, 2♂. **Pulaski Co.**, Little Rock, 13 Aug. 1985, R. Shields, ♀. **Sharp Co.**, South Big Creek at St. Hwy 115 bridge, 5 Sept. 1988, G. L. Harp, ♂. First definitive report of *P. varius* in Arkansas (Fig. 1); some specimens above previously reported only as a *Paragordius* sp. from the state (see Huggins and Harp 1983, Cochran and Harp 1990,

Chordas et al. 1996). A summary of the previously known records of *P. varius* was provided by Schmidt–Rhaesa et al. (2003). However, more recently, Harp et al. (2008) and McAllister et al. (2013) reported *P. varius* from Missouri and Oklahoma, respectively. The species has also been reported from Arizona, California, the District of Columbia, Hawaii, Illinois, Indiana, Kansas, Kentucky, Maine, Massachusetts, Michigan, Missouri, Nebraska, New Jersey, New Mexico, New York, Ohio, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Wisconsin, and Alberta, Ontario, and Quebec, Canada (Schmidt–Rhaesa et al. 2003).

Gordius sp. (“complex”)—**Columbia Co.**, Magnolia, 3 Jan. 1982, H. W. Robison, 70 (sex undetermined). **Craighead Co.**, Jonesboro, 29 Nov. 1988, B. Griffith, ♂; Jonesboro, Simmons Bank parking lot, 22 Feb. 1994, P. Daniel, ♂; Patrick Street, Jonesboro, 7 Dec. 1994, unknown collector, ♂. **Howard Co.**, Cossatot River at St. Hwy 4 bridge, 10 May 1997, H. W. Robison, ♂, ♀. **Independence Co.**, Batesville, 3 Apr. 1999, J. Wells, ♂. **Montgomery Co.**, Caddo River just above confluence with South Fork, 28 Dec. 1985, P. Raines, 2♂, ♀; Brushy Creek, 24 Aug. 1991, unknown collector, ♂. **Randolph Co.**, Janes Creek at St. Hwy 90 bridge, 15 Feb. 1985, 17 Mar. 1985, 15 Nov. 1985, & 15 Dec. 1985, S. Moulton, 4♀. **Sharp Co.**, Rock Creek, 5.6 km N of Sitka, 22 Mar. 1980, G. L. Harp, ♂, ♀. **Stone Co.**, wellhouse, 23 Feb. 1987, M. Cartwright, sex unknown (specimen degraded). **White Co.**, Searcy, Harding University, 16 Nov. 2006, S. Gray, ♂. We report 9 new county records for horsehair worms of the *Gordius* sp. (complex) (Fig. 1). Cochran and Harp (1990) previously reported a *Gordius* sp. from Poinsett County.

In addition to Arkansas, *Gordius robustus* has been documented previously from California, Colorado, Georgia, Hawaii, Idaho, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Montana, Nebraska, New Jersey, New Mexico, New York, North Carolina, Oklahoma, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, and Wisconsin, and Alberta and New Brunswick, Canada (Schmidt–Rhaesa et al. 2003).

The name *Gordius robustus* has been used for gordiids found across North America with a (1) postcloacal crescent in the ♂, and (2) cuticle devoid of areolation (Schmidt–Rhaesa et al. 2003). However, recent behavioral observations and genetic study has

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shown that *G. robustus* consists of a cryptic species complex containing as many as 8 species (B. Hanelt *pers. obs.*). In the future, the exact identity of the worms collected as part of the current study will be determined using genetic markers.

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