
Helminth Parasites (Cestoda: Nematoda) of Baird's Pocket Gopher, *Geomys breviceps* (Rodentia: Geomyidae) from Northeastern Texas

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Abstract: Little is known about the helminth parasites of Baird's pocket gopher, *Geomys breviceps*, particularly from specimens collected and examined from northeastern Texas. Four adult pocket gophers collected from Lamar ($n = 3$) and Titus ($n = 1$) counties yielded a cyclophyllidean tapeworm, *Hymenolepis* sp. in two (50%), and spirurid nematodes, *Mastophorus muris* in one (25%). These tapeworms were the same morphologically but new information suggests significant difference in mitochondrial sequences representative of a new species. The nematode represents a new geographic record and confirms our belief that there may be more than one species of *M. muris* present in the USA.

Introduction

Baird's pocket gopher, *Geomys breviceps* Baird, 1855 is native to eastern Texas, western Louisiana, eastern Oklahoma, and southwestern Arkansas (Sulentich et al. 1991). There are two subspecies: *Geomys breviceps breviceps* Baird, 1855 (in far eastern Louisiana) and *G. b. sagittalis* Merriam, 1895 (in Arkansas, Louisiana, Oklahoma, and Texas). In Texas, *G. breviceps* occurs in the eastern sector of the state (Schmidly and Bradley 1994). This gopher, like others, is a burrower that digs tunnels in sandy to loamy soils and generally lives underground, except during the rainy seasons.

In terms of previously reported endoparasites, *G. breviceps* has been reported with

a coccidian, *Eimeria geomydis* Skidmore, 1929, tapeworms, *Monoecocestus anoplocephaloides* (Douthitt, 1915) and *Hymenolepis* spp., and nematodes, *Litomosoides westi* Gardner and Schmidt, 1986, *Protospirura ascaroidea* Hall, 1916, and *Mastophorus muris* (Gmelin, 1790) (Douthitt 1915; English 1932; Upton et al. 1992; Pitts et al. 2000; Connior et al. 2017). The purpose of the current study was to examine *G. breviceps* from northeastern Texas for endoparasites and report any new host and geographic distribution records.

Methods

During December 2024 ($n = 3$) and January 2025 ($n = 1$), four adult *G. breviceps* (three from Lamar County and one from Titus County),

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was collected with Victor® gopher traps and examined for helminth parasites. Four tapeworms was removed from the small intestine and select terminal proglottids were placed in 80% (v/v) DNA grade ethanol for molecular analysis and the remaining strobilae was fixed in hot 4% (v/v) formalin. Specimens from formalin were dehydrated in an increasing series of ethanol, stained in Semichon's acetocarmine, cleared in methyl salicylate, and mounted in Canada balsam. A nematode from the stomach was fixed in hot distilled water and transferred to DNA grade ethanol. It was examined as a temporary mount on a microscopic slide in glycerol.

Voucher specimens of hosts (alcoholics) were deposited in the Northeast Texas Community College Vertebrate Collection, Mt. Pleasant, Texas. Voucher parasites were deposited in the Harold W. Manter Laboratory of Parasitology (HWML), University of Nebraska, Lincoln, Nebraska.

Results and Discussion

Four tapeworms (two each) were found in the small intestine of two *G. breviceps*, and a single nematode was in the stomach of one individual. Detailed information on these infections are presented below in annotated format.

Cestoda: Cyclophyllidea: Hymenolepididae

Hymenolepis sp. Weinland, 1858

(Figs. 1A-D, 2)

Hosts: Baird's pocket gopher, *Geomys breviceps* (Baird, 1855), adult (total length 203, tail length 51, hind foot 26, ear 3 mm), collected 3 December 2025; adult (total length 223, tail length 49, hind foot 27, ear 6 mm), collected 5 January 2025.

Localities: USA: Texas: Titus County, Northeast Texas Community College campus (34°27'43.4484"N, 93°59'54.3264"W); Lamar County, northeast of Blossom off US 82 (33°39'55"N, 95°19'12"W).

Deposited material: HWML 218133 (photovoucher).

Prevalence: Two of 4 (50%).

Site of infection: Small intestine.

Intensity: Four worms, two in each host.

Other reported pocket gophers in the Nearctic and northern Neotropical regions with Hymenolepis s.str.: Volcán De Toluca pocket gopher, *Cratogeomys planiceps* Merriam, plains pocket gopher, *Geomys bursarius* (Shaw), Attwater's pocket gopher, *Geomys attwateri* Merriam, Sand Hills pocket gopher, *Geomys lutescens* Merriam, Central Texas pocket gopher, *Geomys texensis* Merriam, Camas pocket gopher, variable pocket gopher, *Heterogeomys heterodus* (Peters), *Thomomys bulbivorus* (Richardson), Botta's pocket gopher, *Thomomys bottae* (Eydox and Gervais), mountain pocket gopher, *Thomomys monticola* (J.A. Allen), northern pocket gopher, *Thomomys talpoides* (Richardson), southern pocket gopher, *Thomomys umbrinus* (Richardson) (Gardner et al. 2020; also see summary in Dursahinhan et al. 2023).

Geographic range of *Hymenolepis* s.str. in pocket gophers in the Nearctic and northern Neotropical regions: USA: California, Colorado, Illinois, Indiana, Minnesota, Nebraska, Oklahoma, Oregon, Utah, Washington (Douthitt 1915; English 1932; Gardner and Schmidt 1988; Dursahinhan et al. 2023); **Texas** (English 1932; LaBrasseur 2017 [unpublished]; **this report**). México, State of Mexico, Toluca (Gardner et al. 2020). Costa Rica, Potrero Cerrado, Cartago (Gardner et al. 2020).

Remarks

These *Hymenolepis* tapeworms from both gophers from different county localities (87 km apart) were morphologically identical (Figs. 1A-D). Interestingly, their mitochondrial DNA sequences did not match anything from GenBank (VV Tkach, *pers. comm.*). It has been suggested (SL Gardner, *pers. comm.*) these specimens are either *Hymenolepis weldensis* Gardner and Schmidt, 1988 or *Hymenolepis geomydis* Gardner and Schmidt, 1988 described from *G. bursarius* from Nebraska (Gardner and Schmidt 1988). The length of the medial hooks of the larvae is the distinguishing morphological characteristic between these two taxa; otherwise, it is difficult to differentiate them from one another. Various multivariate statistics of different measurements is necessary to separate the two.

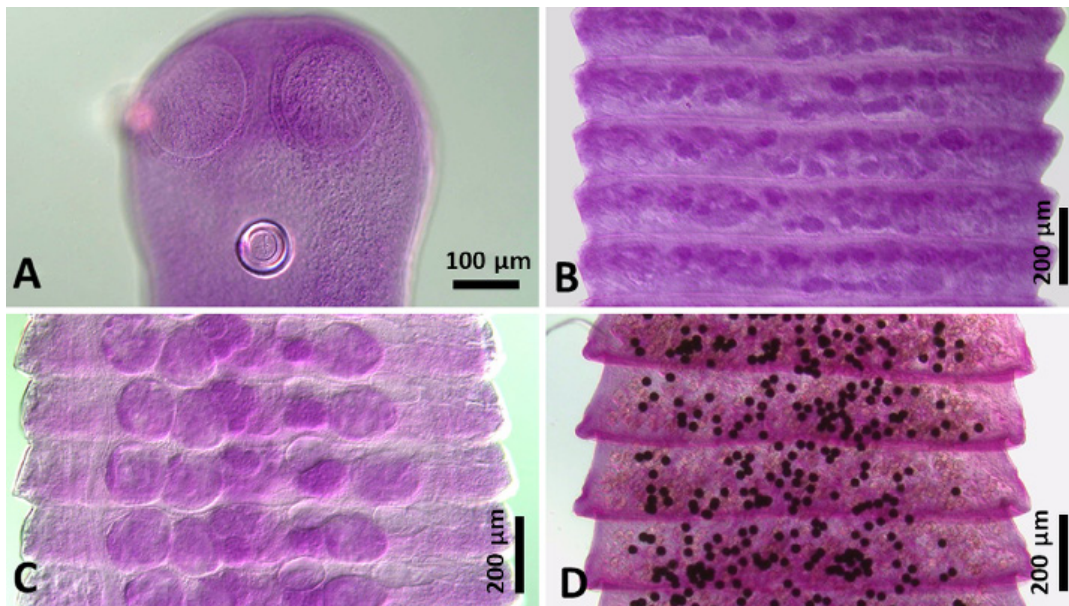


Figure 1. *Hymenolepis* sp. from *Geomys breviceps*. (A) Scolex (with rogue ovum). (B) Immature proglottid. (C) Mature proglottid with numerous large testes and centrally located ovary. (D) Gravid proglottid showing numerous ova (black dots).



Figure 2. Ovum of *Hymenolepis* sp. showing degree of development of hooks of embryo with typical dimorphic hooks of the lateral pairs and the monomorphic hooks of the central pair in the larval embryophore.

Nematoda: Spiruroidea: Spirocercidae
***Mastophorus muris* (Gmelin, 1790)**

Hosts: Baird's pocket gopher, *Geomys breviceps* (Baird, 1855), adult (total length 220, tail length 65, hind foot 28, ear 5 mm), collected 5 January 2025.

Localities: USA: Texas: Lamar County, northeast of Blossom off US 82 (33°39'55"N, 95°19'12"W).

Deposited material: Retained for molecular analysis.

Prevalence: One of 4 (25%).

Site of infection: Stomach.

Intensity: One worm.

Other reported North American pocket gopher hosts with M. muris: southeastern pocket gopher, *Geomys pinetis* Rafinesque (Hubbell and Goff 1939); *G. breviceps* (Connior et al. 2017).

Geographic range in North American pocket gophers of M. muris: USA: Arkansas (Connior et al. 2017), Florida (Hubball and Goff 1939); **Texas (this report);**

Remarks

Recently, Jost et al. (2024) recognized two groups of *M. muris* without a change in their formal taxonomy: one collection were from specimens infecting house mice, *Mus musculus* (L.) and the second group including various taxa infecting non-*Mus* rodents. However, recovery of the current specimen confirms our belief that there may be more than one species of *M. muris* present in the USA, and mitochondrial DNA se-

quencing is ongoing (VV Tkach, *pers. comm.*).

Various specimens of *M. muris* from western Texas are deposited in the Museum at Texas Tech University Invertebrate Zoology Collection from hispid cotton rats, *Sigmodon hispidus* Say and Ord (<https://www.gbif.org/occurrence/2556318850>). However, this is the first time, to our knowledge, that *M. muris* has been documented from Texas in *G. breviceps*.

There are 10 species of *Hymenolepis* s.str. known from North America (Rowan et al. 2022). They infect a wide range of rodents, including arvicolines, geomyids, neotomines, and sciurids (Makarikov et al. 2015; Hoberg et al. 2016; Gardner et al. 2020). The life cycle is indirect and transmission occurs by ingestion of infected tissues of various intermediate hosts such as coprophilic arthropods of three insect orders (Coleoptera, Lepidoptera, and Siphonaptera).

Douthitt (1915) reported numerous individuals of eight different species of *Hymenolepis* from various gophers, including *G. breviceps* collected in Oklahoma and Texas; however, he did not indicate what species of tapeworm was involved. Likewise, English (1932) only identified specimens as *Hymenolepis* sp. from Texas *G. bursarius*. Burnham (1953) reported the rat tapeworm, *Hymenolepis diminuta* (Rudolphi, 1819) from supposed Baird's pocket gophers from Marshall County, Oklahoma; however, both *G. bursarius* and *G. breviceps* occur in that county (Caire et al. 2024) so we will never be able to know what species was the true host as vouchers were not mentioned. In an unpublished thesis, LeBrasseur (2017, his Fig. 4) reported *Hymenolepis* spp. from *G. attwateri*, *G. bursarius*, and *G. texensis* from Texas.

The tapeworms from our study were found to be significantly different in mitochondrial sequences (VV Tkach, *pers. comm.*, not shown) from the closest sequenced species, *Hymenolepis ackerti* Rowan, Hope and Jimenéz, 2022, recently described from symbiotype cotton rats, *Sigmodon hispidus* Say and Ord, and also reported in eastern woodrats, *Neotoma floridana* (Ord), and prairie voles, *Microtus ochrogaster* Wagner from

Kansas (Rowan et al. 2022). Examination of museum specimens, particularly from those previously described by Gardner and Schmidt (1988) from different species of pocket gophers (*Geomys* and *Thomomys*) in Colorado and Oregon should be completed to help diagnose the current species. However, unfortunately, there are no DNA sequences to compare from those samples. Nevertheless, we believe that our samples represent a novel species to be described in a future separate paper.

The nematode, *Mastophorus muris*, is a cosmopolitan roundworm species primarily infecting wild and urban rodents, from *M. musculus* to rice rats (*Oryzomys* spp.), but also other less frequent mammalian hosts such as marsupials and carnivores, including canines and felines (Baylis 1927; Smales 1995; Torres et al. 1998, 2001; Smith and Kinsella 2011) that uses insects (Orthoptera, Dermaptera, Blattodea, and Siphonaptera) as intermediate hosts in a euryxenous life cycle. In one study, several *M. muris* was found in the stomach of two of eight (25%) *G. breviceps* from Benton County, Arkansas (Connior et al. 2017).

In conclusion, we document some new geographic distributional records for two endoparasites of *G. breviceps* from northeastern Texas. One noteworthy helminth, an unknown species of tapeworm of the genus *Hymenolepis* sp., may be a new species. Additional work is necessary to completely sequence this parasite as well as compare it to previously known *Hymenolepis* spp. from pocket gophers.

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