

Endangered Karst Invertebrate Taxonomy of Central Texas

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1.0 INTRODUCTION

The purpose of this document is to provide up-to date taxonomic information for the sixteen endangered karst invertebrates that occupy caves and karst areas in Bexar, Travis, and Williamson counties, Texas. It covers six insects (three ground beetles and three mold beetles) and ten arachnids (three harvestmen, six spiders, and one pseudoscorpion). Methods to collect specimens for taxonomic identification are also provided as well as a list of taxonomists that are qualified to provide identifications. This document will be updated periodically as we receive more information. Future updates will be posted on the Austin Office's website in the Terrestrial Karst Invertebrates library collection at <https://www.fws.gov/library/collections/terrestrial-karst-invertebrates>.

2.0 ENDANGERED KARST INVERTEBRATE TAXONOMY

Taxonomic verification of these species is usually not possible in the field and typically requires examination of adult specimens under a microscope, dissection of the genitalia by a taxonomic expert, and/or for the *Cicurina* species, DNA identification. The following are the species covered in this document:

Insects:

- *Rhadine exilis*, *R. infernalis*, and *R. persephone* (small, essentially eyeless ground beetles)
- *Batrisodes venyivi*, *B. texanus*, and *Texamaurops reddelli* (small, eyeless mold beetles)

Arachnids:

- *Texella cokendolpheri*, *T. reddelli*, and *T. reyesi* (small, eyeless harvestmen (i.e., daddy-longlegs))
- *Tayshaneta microps*, *T. myopica*, *Cicurina baronia*, *C. madla*, *C. venii*, and *C. vespera* (small, eyeless, or essentially eyeless spiders)
- *Tartarocreagris texana* (small, eyeless pseudoscorpion)

2.1 *Batrisodes texanus* (Coffin Cave mold beetle)

Scientific Name: *Batrisodes (Excavodes) texanus*

Common Name: Coffin Cave mold beetle

Description: This species was originally listed as the Kretschmarr Cave mold beetle (*Texamaurops reddelli*) (Barr 1974a) then later split into two species: the Kretschmarr Cave mold beetle and Coffin Cave mold beetle (*Batrisodes texanus*) (Chandler 1992). Chandler and Reddell (2001) further split *B. texanus* into *B. texanus* and *B. cryptotexanus*. Chandler et al. (2009) again stated that these are two distinct species described by Chandler (1992). The Service has not yet officially recognized this taxonomic revision and considers everything identified as either *B. texanus* or *B. cryptotexanus* to be in the entity listed as endangered.

Type Specimen: The male holotype was collected from Inner Space Cavern, Williamson County, Texas, on May 23, 1965, by William Russell. The holotype is curated at the Field Museum of Natural History (Chandler 1992).

Selected Characteristics: Length 0.10-0.11 inches (in) (2.60-2.88 millimeter (mm)). This is a tiny, reddish-brown beetle that superficially resembles an ant (Figure 1).

Taxonomic Classification: Class Insecta (insects), Order Coleoptera (beetles), Suborder Polyphaga, Family Staphylinidae, Subfamily Pselaphinae (mold beetles), Tribe Batrisini, Genus *Batrisodes*, Subgenus *Excavodes*.

Distribution: Williamson County

Figure 1. *Batrisodes texanus*



Photo by Dr. Kemble White

2.2 *Batrisodes venyivi* (Helotes mold beetle)

Scientific Name: *Batrisodes (Excavodes) venyivi*

Common Name: Helotes mold beetle

Description: This species was described by Chandler (1992).

Type Specimen: The male holotype was collected from Helotes Hilltop Cave, Bexar County, Texas, on September 29, 1984, by J. Ivy and G. Veni (Chandler 1992).

Selected Characteristics: Length 0.08 in (2.24 mm) (Chandler 1992). This tiny, reddish-brown beetle superficially resembles an ant. A congener (member of the same genus) is shown in the figure above to illustrate the general morphology of the genus (Figure 1).

Taxonomic Classification: Class Insecta (insects), Order Coleoptera (beetles), Suborder Polyphaga, Family Staphylinidae, Subfamily Pselaphinae (mold beetles), Tribe Batrisini, Genus *Batrisodes*, Subgenus *Excavodes*.

Distribution: Bexar County

2.3 *Cicurina baronia* (Robber Baron Cave meshweaver)

Scientific Name: *Cicurina (Cicurella) baronia*

Common Name: This species has been referred to by two common names, the Robber Baron Cave spider (Service 2000) and the Robber Baron Cave meshweaver (Breene et al. 2003). The latter name is now accepted as the official common name (Breene et al. 2003).

Description: The species was described by Gertsch (1992).

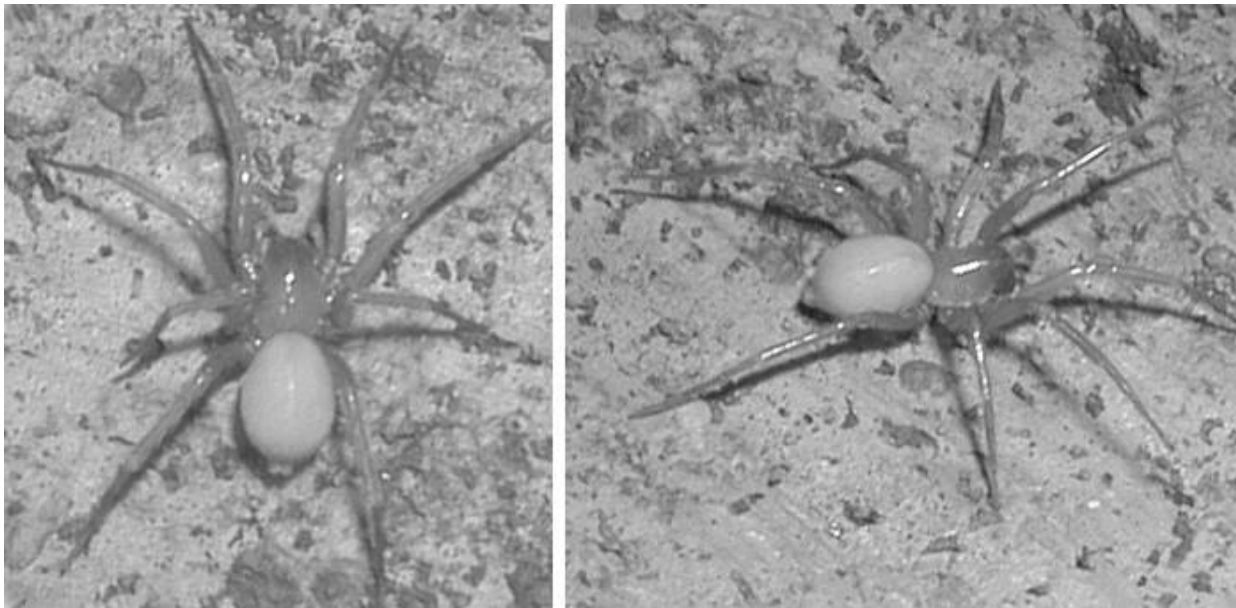
Type Specimen: The female holotype was collected by R. Bartholomew from Robber Baron Cave, Bexar County, Texas, in April 1969 (Gertsch 1992).

Selected Characteristics: This species is eyeless and has reduced pigment (Figure 2). Additional descriptive information on this species is found in Cokendolpher (2004), Reddell and Cokendolpher (2004), Paquin and Hedin (2004), and Paquin and Dupérré (2009).

Taxonomic Classification: Class Arachnida (arachnids), Order Araneae (spiders), Family Hahniidae, Genus *Cicurina*, Subgenus *Cicurella*. Garrison et al. (2016) placed the Dictynidae family, represented by *Cicurina* specimens, as a sister group to Hahniidae. However, Wheeler et al. (2017) moved *Cicurina* from Dictynidae to Hahniidae. This placement in Hahniidae was accepted by the World Spider Catalog (2019).

Distribution: Bexar County

Figure 2. *Cicurina baronia* from Robber Baron Cave



Photos by Dr. Jean Krejca

2.4 *Cicurina madla* (Madla Cave meshweaver)

Scientific Name: *Cicurina (Cicurella) madla*

Common Name: This species has been referred to by two common names, Madla's Cave Spider (Service 2000) and Madla Cave meshweaver (Breene et al. 2003). The latter name is now accepted as the official common name (Breene et al. 2003).

Description: The species was described by Gertsch (1992).

Type Specimen: The female holotype was collected by D. McKenzie and J. Reddell in Madla's Cave, 3.1 miles (mi) (5 kilometers (km)) north of Helotes, Bexar County, Texas, on October 4, 1963 (Gertsch 1992).

Selected Characteristics: This species is eyeless and has reduced pigment (Figure 3). Additional descriptive information on this species is found in Cokendolpher (2004), Reddell and Cokendolpher (2004), Paquin and Hedin (2004), Paquin and Dupérré (2009) and Hedin et al. (2018).

Taxonomic Classification: Class Arachnida (arachnids), Order Araneae (spiders), Family Hahniidae, Genus *Cicurina*, Subgenus *Cicurella*. Garrison et al. (2016) placed the Dictynidae family, represented by *Cicurina* specimens, as a sister group to Hahnidae. However, Wheeler et al. (2017) moved *Cicurina* from Dictynidae to Hahnidae. This placement in Hahnidae was accepted by the World Spider Catalog (2019). In addition, Hedin et al. (2018) synonymized the *C. venii* under *C. madla* based on morphologic characteristics and mitochondrial and nuclear DNA results. This synonymy has also been accepted by the World Spider Catalog (2019).

Distribution: Bexar County

Figure 3. *Cicurina madla* from a cave in Government Canyon State Natural Area



Photos by Dr. Jean Krejca

2.5 *Cicurina venii* (Braken Bat Cave meshweaver)

Scientific Name: *Cicurina (Cicurella) venii*

Common Name: The Service (2000) listed no common name for this species. The Committee on Common Names of Arachnids (Breene et al. 2003) listed the official common name of this species as the Braken Bat Cave meshweaver, which is now accepted as the official common name (Breene et al. 2003).

Description: The species was described by Gertsch (1992).

Type Specimen: The female holotype was collected in Braken Bat Cave on November 22, 1980, by G. Veni (Gertsch 1992, Paquin and Dupérré 2009).

Selected Characteristics: This species is eyeless and has reduced pigment. A congener is shown to illustrate the general morphology of the genus (Figure 3). Additional descriptive information on this species is found in Cokendolpher (2004), Reddell and Cokendolpher (2004), Paquin and Hedin (2004), and Paquin and Dupérré (2009) and Hedin et al. (2018).

Taxonomic Classification: Class Arachnida (arachnids), Order Araneae (spiders), Family Hahniidae, Genus *Cicurina*, Subgenus *Cicurella*. Garrison et al. (2016) placed the Dictynidae family, represented by *Cicurina* specimens, as a sister group to Hahnidae. However, Wheeler et al. (2017) moved *Cicurina* from Dictynidae to Hahnidae. This placement in Hahnidae was accepted by the World Spider Catalog (2019). Hedin et al. (2018) synonymized the *C. venii* under *C. madla* based on morphologic characteristics and mitochondrial and nuclear DNA results. This synonymy has also been accepted by the World Spider Catalog (2019). Based on this, the Service has proposed removing *C. venii* from the Federal List of Endangered and Threatened Wildlife in a September 30, 2021, Federal Register Notice (FR 86 54145). Protections for populations formerly attributed to *C. venii* would remain the same because *C. madla* is also listed under the Act.

Distribution: Bexar County

2.6 *Cicurina vespera* (Government Canyon Bat Cave meshweaver)

Scientific Name: *Cicurina (Cicurella) vespera* (Gertsch).

Common Name: This species has been referred to by two common names, the vesper cave spider (Service 2000) and the Government Canyon Bat Cave meshweaver (Breene et al. 2003). The latter name has been accepted as the official common name (Breene et al. 2003).

Description: The species was described by Gertsch (1992).

Type Specimen: The female holotype was collected from Government Canyon Bat Cave on August 11, 1965, by J. Fish and J. Reddell (Gertsch 1992).

Selected Characteristics: This species is eyeless and has reduced pigment. A congener is shown to illustrate the general morphology of the genus (Figure 3). Additional descriptive information on this species is found in Cokendolpher (2004), Reddell and Cokendolpher (2004), Paquin and Hedin (2004), and Paquin and Dupérré (2009) and Hedin et al. (2018).

Taxonomic Classification: Class Arachnida (arachnids), Order Araneae (spiders), Family Hahniidae, Genus *Cicurina*, Subgenus *Cicurella*. A possible synonymy between *C. vespera* and *C. madla* was suggested by the molecular analysis of Paquin and Hedin (2004); however, based on the female morphology and the trologmorphic index of the type specimen examined in Hedin et al. (2018), *C. vespera* was found to be more like *C. loftini*. Hedin et al. (2018) suggests that this is possible either if *C. vespera* occurs in sympatry with *C. madla* or if the type locality for *C. vespera* is incorrect. Hedin et al. (2018) synonymized *C. loftini* under *C. vespera* and this synonymy was accepted by the World Spider Catalog (2019).

Distribution: Bexar County

2.7 *Tayshaneta microps* (Government Canyon Bat Cave spider)

Scientific Name: *Tayshaneta microps*

Common Name: This species has been referred to by two common names, the Government Canyon cave spider (Service 2000) and the Government Canyon Bat Cave spider (Breene et al. 2003). The latter name is now accepted as the official common name (Breene et al. 2003).

Description: *Tayshaneta microps* was first collected in 1965 and described by Gertsch (1974) as *Leptoneta microps*. The species was reassigned to *Neoleptoneta* following Brignoli (1977) and Platnick (1986). A review of the taxonomic history of nearctic leptonetids is available in Ubick et al. (2005). Ledford et al. (2011) transferred the species to *Tayshaneta* in a phylogenetic assessment of *Neoleptoneta*. The Service recognized this taxonomic revision on November 26, 2021 (FR 86 67352).

Type Specimen: The female holotype was collected from Government Canyon Bat Cave, Bexar County, Texas on August 11, 1965, by J. Fish and J. Reddell (Gertsch 1974).

Selected Characteristics: This is a small, yellowish, essentially eyeless troglobitic spider. A congener is shown to illustrate the general morphology of the genus (Gertsch 1974) (Figure 4).

Taxonomic Classification: Class Arachnida (arachnids), Order Araneae (spiders), Infraorder Araneomorphae (true spiders), Family Leptonetidae.

Distribution: Bexar County

2.8 *Tayshaneta myopica* (Tooth Cave spider)

Scientific Name: *Tayshaneta myopica*

Common Name: Tooth Cave spider

Description: *Tayshaneta myopica* was described by Gertsch (1974) as *Leptoneta myopica*. The species was reassigned to *Neoleptoneta* following Brignoli (1977) and Platnick (1986). A review of the taxonomic history of nearctic leptonids is available in Ubick et al. (2005). Ledford et al. (2011) transferred the species to *Tayshaneta* in a phylogenetic assessment of *Neoleptoneta*. The Service recognized this taxonomic revision on November 26, 2021 (FR 86 67352).

Type Specimen: The female holotype was collected from Tooth Cave, Travis County, Texas, on March 30, 1965, by J. Reddell (Gertsch 1974). The holotype is curated at the American Museum of Natural History (Ledford 2011).

Selected Characteristics: Body length is 0.06 in (1.6 mm). This is a small, yellowish/whitish, essentially eyeless troglobite. A congener is shown to illustrate the general morphology of the genus (Gertsch 1974) (Figure 4).

Taxonomic Classification: Class Arachnida (arachnids), Order Araneae (spiders), Infraorder Araneomorphae (true spiders), Family Leptonetidae.

Distribution: Travis and Williamson Counties

Figure 4. *Tayshaneta myopica*



Photo by Dr. Jean Krejca

2.9 *Rhadine exilis* (no common name)

Scientific Name: *Rhadine exilis*

Common Name: This species has no common name.

Description: This species was originally described as *Agonum exile* by Barr and Lawrence (1960). Later this species was referred to as *Rhadine exilis* by Reddell (1966) in a checklist. Barr (1974b) formally reassigned the species to the genus *Rhadine*.

Type Specimen: The male holotype (the only specimen collected) was collected from Marnock Cave, 0.99 mi (1.6 km) north of Helotes, Bexar County, Texas, on July 2, 1959 by J. F. Lawrence and F. Moore (Barr 1974b).

Selected Characteristics: Mean length is 0.29 in (7.4 mm). Body is extremely slender (Figure 5).

Taxonomic Classification: Class Insecta (insects), Order Coleoptera (beetles), Suborder Adephaga, Family Carabidae (ground beetles), Tribe Agonini (agonines).

Distribution: Bexar County

Figure 5. *Rhadine exilis* (on right)



Photo by Dr. Jean Krejca

2.10 *Rhadine infernalis* (no common name)

Scientific Name: *Rhadine infernalis*

Common Name: This species has no common name.

Description: This species was originally described as *Agonum infernale* by Barr and Lawrence (1960). Barr (1974b) reassigned the species to the genus *Rhadine*.

Type Specimen: The male holotype was collected from Madla's Cave, 3.1 mi (5 km) north of Helotes, Bexar County, Texas, on July 6-7, 1959, by J. F. Lawrence and J. R. Reid (Barr 1974b).

Selected Characteristics: Mean length is 0.28 in (7.2 mm). Body is robust (Figure 6).

Intraspecific Variation: Taxonomists have delineated three subspecies (*R. infernalis ewersi*, *R. infernalis infernalis*, and *R. infernalis* ssp.). Two have been formally described (Barr 1960). In a more recent report, the third subspecies was characterized as valid, but was not formally described (Reddell 1998).

Taxonomic Classification: Class Insecta (insects), Order Coleoptera (beetles), Suborder Adephaga, Family Carabidae (ground beetles), Tribe Agonini (agonines).

Distribution: Bexar County

Figure 6. *Rhadine infernalis*



Photo by Dr. Jean Krejca

2.11 *Rhadine persephone* (Tooth Cave ground beetle)

Scientific Name: *Rhadine persephone*

Common Name: Tooth Cave ground beetle

Description: This species was originally described by Barr (1974b).

Type Specimen: The male holotype was collected from Tooth Cave, Travis County, Texas, on May 16, 1965 by R. W. Mitchell, T.C. Barr, and W.M. Andrews (Barr 1974b). The holotype is curated at the Museum of Natural History (Barr 1974b).

Selected Characteristics: Body length is 0.28-0.34 in (7.2-8.7 mm). Body is robust (Barr 1974b) (Figure 7).

Taxonomic Classification: Class Insecta (insects), Order Coleoptera (beetles), Suborder Adephaga, Family Caribidae (ground beetles), Tribe Agonini (agonines)

Distribution: Travis and Williamson Counties

Figure 7. *Rhadine persephone*



Photo by Dr. Jean Krejca

2.12 *Tartarocreagris texana* (Tooth Cave pseudoscorpion)

Scientific Name: *Tartarocreagris texana*

Common Name: Tooth Cave pseudoscorpion

Description: This species was originally described as *Microcreagris texana* by Muchmore (1969). The genus *Microcreagris* was reassigned to *Tartarocreagris* following Muchmore (1992).

Type Specimen: The female holotype was collected from Tooth Cave, Travis County, Texas, on May 16, 1965, by James Reddell. The holotype is curated at the American Museum of Natural History (Muchmore 1992).

Selected Characteristics: Body 0.16 in (4.1 mm). This is an eyeless pseudoscorpion. The upper portion of the body (carapace, chelicerae and palps) are golden brown, body and legs are light tan (Muchmore 1969). A congener is shown to illustrate the general morphology of the genus (Figure 8).

Taxonomic Classification: Class Arachnida (arachnids), Order Pseudoscorpiones, family Neobisiidae

Distribution: Travis County

Figure 8. *Tartarocreagris attenuata*



Photo by Mark Sanders

2.13 *Texamaurops reddelli* (Kretschmarr Cave mold beetle)

Scientific Name: *Texamaurops reddelli*

Common Name: Kretschmarr Cave mold beetle

Description: This species was originally described by Barr and Steeves (1963)

Type Specimen: The female holotype was collected from Kretschmarr Cave, Travis County, Texas on March 2, 1963, by James Reddell and David McKenzie (Barr and Steeves 1963). The holotype is curated at the Field Museum of Natural History Chicago.

Selected Characteristics: Body length is 0.10-0.15 in (2.72-3.96 mm). A small reddish-brown beetle with attenuated (long) legs (Barr and Steeves 1963).

Taxonomic Classification: Class Insecta (insects), Order Coleoptera (beetles), Suborder Polyphaga, Family Staphylinidae, Subfamily Pselaphinae (mold beetles), Tribe Batrisini.

Distribution: Travis County

2.14 *Texella cokendolpheri* (Cokendolpher cave harvestman)

Scientific Name: *Texella cokendolpheri*

Common Name: This species has been referred to by two common names, the Robber Baron Cave harvestman (Service 2000) and the Cokendolpher cave harvestman (Breene et al. 2003). The latter name is now accepted as the official common name (Breene et al. 2003).

Description: This species was described by Ubick and Briggs (1992).

Type Specimen: The male holotype was collected from Robber Baron Cave, Bexar County, Texas, on April 3, 1982, by A. Grubbs (Ubick and Briggs 1992).

Selected Characteristics: Pale orange. A congener is shown to illustrate the general morphology of the genus (Figure 9).

Taxonomic Classification: Class Arachnida (arachnids), Order Opiliones (opilionids, or harvestmen), Suborder Laniatores, Family Phalangodidae.

Distribution: Bexar County

Figure 9. *Texella tuberculata* showing general *Texella* morphology



Photos by Dr. Jean Krejca

2.15 *Texella reddelli* (Bee Creek Cave harvestman)

Scientific Name: *Texella reddelli*

Common Name: Bee Creek cave harvestman (Goodnight and Goodnight 1967)

Description: This species was described by Goodnight and Goodnight (1967).

Type Specimen: The male holotype was collected from Bee Creek Cave (also referred to as Pine Creek Cave), Travis County, Texas, on October 2, 1963, by James Reddell and David McKenzie (Goodnight and Goodnight 1967).

Selected Characteristics: Pale orange. Body length 0.07-0.08 in (1.90-2.18 mm) (Ubick and Briggs 1992). A congener is shown to illustrate the general morphology of the genus (Figure 9 and Figure 10).

Taxonomic Classification: Class Arachnida (arachnids), Order Opiliones (opilionids, or harvestmen), Suborder Laniatores, Family Phalangodidae.

Distribution: Travis County

2.16 *Texella reyesi* (Bone Cave harvestman)

Scientific Name: *Texella reyesi*

Common Name: Bone Cave harvestman (Ubick and Briggs 1992)

Description: This species was described by Ubick and Briggs (1992).

Type Specimen: The male holotype was collected from Bone Cave, Travis County, Texas, on June 4, 1989, by William Elliott, James Reddell, and Marcelino Reyes. The holotype is curated at the California Academy of Science (Ubick and Briggs 1992).

Selected Characteristics: Pale orange. Body length 0.05-0.10 in (1.41-2.67 mm) (Ubick and Briggs 1992) (Figure 10).

Taxonomic Classification: Class Arachnida (arachnids), Order Opiliones (opilionids, or harvestmen), Suborder Laniatores, Family Phalangodidae.

Distribution: Travis and Williamson Counties

Figure 10. *Texella reyesi*



Photo by Mark Sanders

3.0 KARST INVERTEBRATE COLLECTION AND IDENTIFICATION

Endangered karst invertebrates may not be possible to distinguish in the field from closely related species. Therefore, specimens should be collected from locations not known to contain endangered karst invertebrates by an individual that has a valid section 10(a)(1)(A) permit (or Enhancement of Survival permit) from the Service or be accompanied by someone that has such a permit. These collections should be identified as specifically as possible and sent to an appropriate university or museum in the list in Table 1 or to a taxonomist and collection that is approved in writing by the Austin Ecological Services Office (Recovery and Candidate Conservation branch) for taxonomic determination and curation. Please call the Austin Ecological Services Office (512-490-0057 ext. 231) for guidance if you have any questions as to which taxonomist a specimen should be sent to for identification and curation. Documentation from taxonomists regarding specimen identification (including accession or collection numbers) should be provided in all 10(a)(1)(A) permittees' annual reports.

Guidelines to follow while collecting are found in the USFWS Section 10(a)(1)(A) Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates. The most recent version can be found at: <https://www.fws.gov/media/scientific-permit-requirements-conducting-presence-absence-surveys-endangered-karst>.

Table 1. Taxonomists

Species	Taxonomists	Contact Information
<i>Texella</i> species	Darrel Ubick	Department of Entomology California Academy of Science 55 Music Concourse Drive Golden Gate Park San Francisco, CA 94128 (415) 379-5308 dubick@calacademy.org
<i>Cicurina</i> species	Dr. Marshal Hedin	Department of Biology Life Sciences North, Room 204E San Diego State University 5500 Campanile Blvd. San Diego, CA 92182-4614 mhedin@mail.sdsu.edu
<i>Rhadine</i> species	James Reddell	Biodiversity Institute University of Texas Insect Collection 3001 Lake Austin Blvd., Suite 1.314 University of Texas at Austin Austin, TX 78703 (512) 366-2038 jreddell.caves@mail.utexas.edu
<i>Tartarocreagris</i> species	Charles Stephen	Charles Stephen c/o Jonathan Armbruster Dept. Biological Sciences 101 Rouse Life Sciences Bldg Auburn University, AL 36849 (334) 734-9021 czs0021@auburn.edu
<i>Batrisodes</i> and <i>Texamaurops</i> species	Dr. Don Chandler	University of New Hampshire Department of Zoology Durham, NC 03824 (603) 862-1735
<i>Tayshaneta</i> or <i>Texella</i> species	Dr. Joel Ledford	University of California-Davis Department of Plant Biology Sciences Lab Building Davis, CA 95616 (530) 400-4187

4.0 LITERATURE CITED

- Barr, T.C., Jr. 1960. The cavernicolous beetles of the subgenus *Rhadine*, genus *Agonum* (Coleoptera: Carabidae). *American Midland Naturalist* 64(1): 45-65.
- Barr, T.C., Jr. 1974a. The eyeless beetles of the genus *Arianops* Brendel (Coleoptera, Pselaphidae), *Bulletin of the American Museum of Natural History* 154: 1-52.
- Barr, T.C., Jr. 1974b. Revision of *Rhadine* LeConte (Coleoptera, Carabidae) I. The *subterranean* group. *American Museum Novitates* 2539: 30.
- Barr, T.C., Jr. and J.F. Lawrence. 1960. New cavernicolous species of *Agonum* (*Rhadine*) from Texas (Coleoptera: Carabidae). *The Wasmann Journal of Biology* 18: 137-145.
- Barr, T.D. and H.R. Steeves. 1963. *Texamauropus* a new genus of pselaphids from caves in central Texas. (Coleoptera, Pselaphidae). *Coleopterist's Bulletin* 17: 117-120.
- Breene, R.G., D.A. Dean, G.B. Edwards, B. Hebert, H.W. Levi, G. Manning, K. McWest, and L.Sorkin. 2003. Common names of Arachnids 2003. 5th edition. The American Arachnological Society Committee on Common Names of Arachnids. American Tarantula Society.
- Brignoli, P.M. 1977. Spiders from Mexico, III. A new leptonetid from Oaxaca (Araneae, Leptonetidae). *Accademia Nazionale dei Lincei* 171 (3): 213-218.
- Chandler, D.S. 1992. The Pselaphidae (Coleoptera) of Texas caves. *Texas Memorial Museum Speleological Monographs* 3: 241-254.
- Chandler, D.S. and J.R. Reddell. 2001. A review of the ant-like litter beetles found in Texas caves (Coleoptera: Staphylinidae: Pselaphinae), pp. 115-128. *Texas Memorial Museum, Speleological Monographs* 5: 115-128.
- Chandler, D.S., J.R. Reddell, and P. Paquin. 2009. New cave Pselaphinae and records from Texas with a discussion of the relationships and distributions of the Texas troglobitic Pselaphinae (Coleoptera: Staphylinidae: Pselaphinae). *Texas Memorial Museum, Speleological Monograph* 7: 125-140.
- Cokendolpher, J.C. 2004. *Cicurina* spiders from caves in Bexar County, Texas (Araneae: Dictynidae). *Texas Memorial Museum, Speleological Monographs* 6: 13-58.
- Garrison, N.L., J. Rodriguez, I. Agnarsson, J.A. Coddington, CE. Griswold, C.A. Hamilton, M. Hedin, K.M. Kocot, J.M. Ledford, and J.E. Bond. 2016. Spider phylogenomics: untangling the Spider Tree of Life. *PeerJ* 4:e1719; DOI10.7717/peerj.1719.
- Gertsch, W.J. 1974. The spider family Leptonetidae in North America. *The Journal of Arachnology* 1: 145-203.
- Gertsch, W.J. 1992. Distribution patterns and speciation in North American cave spiders with a list of the troglobites and revision of the *Cicurinas* of the subgenus *Cicurella*. *Texas Memorial Museum Speleological Monographs* 3: 75-122.

- Goodnight, C.J. and M.L. Goodnight. 1967. Opilionids from Texas caves (Opiliones, Phalangodidae). American Museum Novitates, No. 2301, 8 pp.
- Hedin, M., S. Derkarabetian, J. Blair, and P. Paquin. 2018. Sequence capture phylogenomics of eyeless *Cicurina* spiders from Texas caves, with emphasis on US federally-endangered species from Bexar County (Araneae, Hahniidae). ZooKeys 769:49–76.
- Ledford, J., P. Paquin, J. Cokendolpher, J. Campbell, and C. Griswold. 2011. Systematics of the spider genus *Neoleptoneta* Brignoli, 1972 (Araneae: Leptonetidae) with a discussion of the morphology and relationships for North American Leptonetidae. Invertebrate Systematics 25: 334-388.
- Muchmore, W.B. 1969. New species and records of cavernicolous pseudoscorpions of the genus *Microcreagris* (Arachnida, Chelonethida, Neobisiidae, Ideobisiinae). American Museum Novitates, No. 2932, 21, pp.
- Muchmore, W.B. 1992. Cavernicolous pseudoscorpions from Texas and New Mexico (Arachnida, Pseudoscorpionida). Texas Memorial Museum Speleological Monographs 3: 127-154.
- Paquin, P. and M. Hedin. 2004. Genetic and morphological analysis of species limits in *Cicurina* spiders (Araneae, Dictynidae) from southern Travis and northern Hays counties (TX), with emphasis on *Cicurina cueva* Gertsch and relatives. Special report for the Department of Interior United States Fish & Wildlife Service Contract No. 201814G959. Revised version 10 May 2005.
- Paquin, P. and N. Dupérré. 2009. A first step towards the revision of *Cicurina*: redescription of type specimens of 60 troglobitic species of the subgenus *Cicurella* (Araneae: Dictynidae), a first visual assessment of their distribution. Zootaxa 2002: 1-67.
- Platnick, N.I. 1986. On the tibial and patellar glands, relationships, and American genera of the spider family Leptonetidae (Arachnida, Araneae). American Museum Novitates 2855: 1-16.
- Reddell, J.R. 1966. A checklist of the cave fauna of Texas. II. Insecta. The Texas Journal of Science 18: 25-56.
- Reddell, J.R. 1966. A checklist of the cave fauna of Texas. II. Insecta. The Texas Journal of Science 18: 25-26.
- Reddell, J.R. 1998. Troglobitic ground beetles of the genus *Rhadine* from Bexar County, Texas. A report prepared for the Texas Parks and Wildlife Foundation.
- Reddell, J.R. and Cokendolpher, J.C. 2004. The cave spiders of Bexar and Comal counties, Texas. Texas Memorial Museum, Speleological Monographs, 6:75-94.
- Service (U.S. Fish and Wildlife Service). 2000. Endangered and threatened wildlife and plants; final rule to list nine Bexar County, Texas invertebrate species as endangered. Federal Register 65: 81419-81433.

- Ubick, D. and T.S. Briggs. 1992. The harvestman family Phalangodidae. 3. Revision of *Texella* Goodnight and Goodnight (Opiliones: Laniatores). Texas Memorial Museum Speleological Monographs, 3, 155-240.
- Ubick, D., P. Paquin, P.E. Cushing, and V. Roth editors. 2005. Spiders of North America: an identification manual. American Arachnological Society, New York.
- Wheeler, W.C., J.A. Coddington, L.M. Crowley, D. Dimitrov, P.A. Goloboff, C.E. Griswold, G. Hormiga, L. Prendini, M.J. Ramírez, P. Sierwald, L. Almeida-Silva, F. Alvarez-Padilla, M.A. Arnedo, L.R. Benavides Silva, S.P. Benjamin, J.E. Bond, C.J. Grismado, E. Hasan, M. Hedin, M.A. Izquierdo, F.M. Labarque, J. Ledford, L. Lopardo, W.P. Maddison, J.A. Miller, L.N. Piacentini, N.I. Platnick, D. Polotow, D. Silva-Dávila, N. Scharff, T. Szűts, D. Ubick, C.J. Vink, H.M. Wood, and J. Zhang. 2017. The spider tree of life: phylogeny of Araneae based on target-gene analyses from an extensive taxon sampling. Cladistics, 33: 574-616.
- World Spider Catalog. 2019. World Spider Catalog. Version 20.0. Natural History Museum Bern. (accessed on 8/15/2019) <http://wsc.nmbe.ch>.