NEW AND RARE NESTICID SPIDERS FROM TEXAS CAVES
(ARANEAE: NESTICIDAE)

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ABSTRACT

Members of the family Nesticidae from caves in Texas are reviewed. *Eidmannella ruckeri*, new species, is described from Phantom Lake Cave, Jeff Davis County. Over 200 new distributional records of *Eidmannella* and 23 of *Gaucelmus* species are recorded. Notes are provided on the maternal care by *Eidmannella* and the general biology of nesticids in Texas caves is reviewed.

INTRODUCTION

Gertsch (1984) revised the taxonomy of the nesticid spiders of North America. He also reviewed the literature relative to our meager knowledge of the biology of this family in North America. Extensive cave explorations in Texas in the last decade have revealed the presence of one undescribed *Eidmannella* species and many new records for both *Eidmannella* Roewer and *Gaucelmus* Keyserling.

While five cavernicolous nesticid species from the southern Appalachians have been proposed for federal listing as threatened or endangered species (Drewry, 1994), none from Texas have thus far been listed as candidate species. Both *Eidmannella reclusa* Gertsch and *E. nasuta* Gertsch are troglobites with limited distributions in or near expanding metropolitan areas of central Texas. Their status should be examined. The new species, we describe herein is known from a single cave oasis in an arid region of western Texas. While urban expansion is not directly a threat to that cave habitat, the increasing needs for water in the nearby towns and for agriculture is a threat to this environment. The spring waters are home to species which are already listed as threatened or endangered. Hopefully, the habitat conservation plan (U.S. Fish and Wildlife Service, 1981) for one of the fish will benefit the new *Eidmannella* species by maintaining a wet cave environment.

Yaginuma (1979), in a study of the nesticids of Japan, noted that only one species was found per cave examined. We have verified the existence of two
different species of nesticids in four caves in Texas. In Robber Baron Cave and Government Canyon Bat Cave, Bexar County, both *E. rostrata* and *E. pallida* have been identified. This same species pair also occurs in East Fork Fissure, Georgetown, Williamson County, but *E. rostrata* is much more numerous. *Gaucelmus augustinus* and *E. pallida* occur in Sore-ped Cave, Williamson County. Unfortunately, data on the relative positions of these spiders in the caves were not recorded. Presumably, *E. pallida* which also lives on the surface occurs nearer the entrances to the caves, whereas the more cave-adapted species occur further inside the caves.

**Gaucelmus Keyserling**

**Gaucelmus augustinus** Keyserling

**Comments.**—This species is the largest nesticid in the state and uncommon compared to *Eidmannella* in Texas caves. Specimens are usually found hanging in webs in overhangs on cave walls.


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**Eidmannella Roewer**

**Eidmannella bullata** Gertsch

**Comment.**—This species is known only from the holotype female from Wiggley Cave, Culberson County, and the record listed below.

**New Record.**—*Texas*: *Culberson County*, Crystal Cave, 14 May 1988 (M. Reyes), 2 females, 4 immatures [1 female JCC].

**Eidmannella delicata** Gertsch

**Comment.**—This species is still known only from Ladder Cave, Val Verde County.

**Eidmannella nasuta** Gertsch

**Comment.**—This species is still known only from the female holotype from Davenport Cave, Medina County.
Eidmannella pallida (Emerton)

Comments.—This widespread species is usually found hanging from webs in small pockets in flowstone or cave walls. Unless the records of immatures are from caves from which adults are recorded, they should be regarded as only tentative. Thus far, the only known caves from which adults are recorded, they should be regarded as only tentative. Thus far, the only known species of Eidmannella with well-developed eyes in the region is E. pallida and therefore immatures with eyes are listed here as that species. This is the only Eidmannella species which is known to occur on the surface in Texas.

June 1996 (J. Reddell, M. Reyes), 1 female; Argo Cave, 25 March 1994 (J. Reddell, M. Reyes), 1 immature; The Bat Well, 4 March 1988 (J. Reddell, M. Reyes), 1 female, 2 immatures; Beck Creek Cave, 3 June 1996 (J. Reddell, M. Reyes), 1 male; Beck Pride Cave, 29 May 1996 (J. Reddell, M. Reyes), 1 immature; Beck Ranch Cave, 9 March 1989 (J. Reddell, M. Reyes), 2 females; Brents Bad Air Cave, April 1994 (M. Warton), 1 immature; Brown's Cave, 23 April 1987 (W. Elliott, J. Reddell, M. Reyes), 1 male; Cassidy Cave, 13 June 1996 (M. Warton), 1 male, 1 female; Cobb Caverns, 11 Feb. 1990 (M. Grimm), 1 male; Deliverance Cave No. 1, 18 Nov. 1993 (J. Reddell, M. Reyes), 2 females, 1 immature; 19 April 2000 (J. Reddell, M. Reyes), 1 female; Do Drop In Cave, 23 Nov. 1993 (J. Reddell, M. Reyes), 1 female; 28 July 1995 (W. Elliott), 1 female; 28 Nov. 1995 (W. Elliott), 1 female; Duckworth Bat Cave, 11 April 1994 (J. Reddell, M. Reyes), 1 female, 6 immatures; East Fork Fissure, Georgetown, 5 July 1991 (W. R. Elliott, D. Green), 1 female; Electro-Mag Cave, 24 July 1995 (J. Reddell, M. Reyes), 1 immature; 12 June 1996 (J. Reddell, M. Reyes), 1 immature; 26 March 2000 (J. Reddell, M. Reyes), 1 female; Florence Cave No. 18, 6 March 1994 (J. Reddell, M. Reyes), 1 immature; Hatchet Cave, 6 March 1994 (J. Reddell, M. Reyes), 1 immature; Holler Hole Cave, 12 June 1996 (J. Reddell, M. Reyes), 1 female; Kiva Cave No. 1, 6 Feb. 1994 (J. Reddell, M. Reyes), 2 females, 1 immature; 6 March 1994 (J. Reddell, M. Reyes), 1 female; 22 July 1995 (J. Reddell, M. Reyes), 2 females, 2 immatures; 30 Sept. 1995 (J. Reddell, M. Reyes), 1 female; Lorfin's Unseen Rattler Cave, 10 Nov. 1990 (W. Elliott, J. Reddell, M. Reyes), 1 female; Off Campus Cave, 8 April 1989 (W. Elliott, J. Reddell, M. Reyes), 6 males, 3 females, 1 immature, 42 eggs; Onion Branch Cave, 29 April 1998 (J. Reddell, M. Reyes), 2 females, 3 immatures; Polaris Cave, 19 April 1994 (J. Reddell, M. Reyes), 1 female, 1 immature; Reach-Around Cave, 25 March 2000 (J. Reddell, M. Reyes), 2 immatures; Rockfall Cave, 27 March 1993 (J. Reddell, M. Reyes), 1 female; Steam Cave, 19 May 1985 (J. Reddell, M. Reyes), 5 females, 6 immatures; Sore- ped Cave, 28 April 1990 (P. Sprouse), 1 immature; Sting Cave, 28 Sept. 1995 (P. Sprouse), 1 male; Texella Cave, 15 Sept. 1995 (A. G. Grubbs), 1 male, 2 females, 6 immatures; 8 April 1996 (M. Warton), 1 male, 3 females; Trail of Tears Cave, 18 Nov. 1993 (J. Reddell, M. Reyes), 1 immature; 16 April 1994 (J. Reddell, M. Reyes), 3 immatures; Turner Goat Cave, 8 April 2000 (J. Reddell, M. Reyes), 1 immature; War Party Cave, 10 April 1994 (J. Reddell, M. Reyes), 2 immatures.

**Eidmannella reclusa** Gertsch

**Comments.**—This species was previously known with certainty only from Tooth Cave, but tentatively identified from two other nearby caves. The five new caves in which this species has been found are all located in the same general area of Travis County.

**New and Verified Records.**—**Travis County:** McDonald (=Schultz) Cave, 18 May 1984 (D. Pate, J. Reddell, M. Reyes), 1 female, 3 immatures (labeled by Gertsch as *E. rostrata*); Plethodon Cave, 25 May 1991 (J. Reddell, M. Reyes), 1 male, 1 female, 2 immatures; Puzzle Pit, 16 Jan. 1995 (M. Warton), 4 immatures; 11 April 1995 (A. G. Grubbs, G. Waid), 1 female, 1 immature [female JCC]; Stovepipe Cave, 25 Oct. 1990 (J. Reddell, M. Reyes), 1 male, 2 females, 2 immatures; 25 Oct. 1990 (L. Sherrod), 2 immatures; Tooth Cave, 7 April 1984 (M. Reyes), 1 female; Twelve Foot Dome Pit, 18 March 1997 (M. Warton), 1 female; Ulls Water Cave, 31 March 2000 (M. Warton), 1 penultimate male; 27 April 2000 (M. Warton), 1 female, 1 immature.

**Eidmannella rostrata** Gertsch

**Comments.**—Ives (1935, 1947), Kaston (1948), Nakamura and Kuramoto (1973), Gertsch (1984), and Reeves (1999) reported that female *Eidmannella pallida* (Emerton), *Nesticus akiyoshiensis* (Uyemura), *Nesticus barri* Gertsch, *Nesticus carteri* Emerton, *Nesticus cellulanus* (Clerck), and *Nesticus georgia* Gertsch drag their egg sacs, attached to the spinnerets. Nobuo Tsurusaki (pers. comm., 9 Aug. 1996) informed us that he had seen many female *Nesticus yeozenis* Yaginuma dragging egg sacs during his field studies in Masruryama, Sapporo, Japan. To this list we can add the troglobitic species *E. rostrata* from Texas; which one of us (JCC) observed dragging an egg sac in captivity. JCC (while in the company of Hedin, Reeves, and Reeves) also observed several females (at least 2 species of cavernicolous *Nesticus*) dragging egg sacs in the Great Smoky Mountains National Park, Tennessee. Although not stated to be dragging the egg sacs, Gertsch (1984) recorded that a collection of *Gaucelmus augustinus* Keyserling from Texas also included egg sacs. Presumably, these either were in close proximity to the females or were being drug by the females. We are unaware of any records of egg sac dragging by other genera of nesticids, but this does not mean that it does not occur. Some *Theridion* spp. (Theridiidae) also drag their egg sacs attached to their
spinnerets (Roberts, 1995), so this behavior may have occurred in the Theridiidae + Nesticidae ancestor.

A female *E. rostrata* collected in Up the Creek Cave, Bexar County, Texas on 14 Nov. 1995 was returned to Lubbock and placed alone in a terrarium. During her time in captivity (cut short by a need for fresh nesticids for a DNA study in the summer of 1996), she produced three fertile egg sacs (producing both male and female offspring). The first eggs were laid in early April, the second on or about 13 May, and the third about one month later in 1996. As this spider was only being maintained as a curiosity, detailed notes were not maintained. The emergence of the young was observed only from the second sac. In each case, the female would sit in the web or on a rock from which the web was connected with the sac being attached to her spinnerets. This attachment was quite strong. It was possible to grasp the sac by a pair of fine-tipped forceps and pull until lifting the spider off the substrate. Only after considerable agitation and pulling would the female drop the sac. Gertsch (1984) suggested that since nesticid spiders do not stray far from their webs that dragging the egg sac could serve as a protective function.

Petrunkevitch (1926) recorded his observations on the emergence of *E. pallida* (listed as *Bathypharates ovigerus*) and made no mention of the spiderlings staying in the web of the mother, indicating that the spiderlings disperse shortly after leaving the egg sac. Likewise, Ives (1947) stated for the troglobilic *Nesticus carteri*: "The female spiders attach their cocoons or egg cases to the posterior part of their abdomen and drag them thus until the little spiderlings come out and 'shift for themselves.'" Only a single other observation of emergence has been published. In that case, Nakamura and Kuramoto (1973) photographed and described the event, but did not state how long the *N. yezoensis* spiderlings remained with their mother. In the case of the *E. rostrata*, which is a troglobite, the spiderlings remained on the outside of the egg sac for approximately three days after emergence (Fig. 1). After leaving the outside of the sac, the spiderlings moved onto the mother's web. The majority of the spiderlings remained on her web for another three days before they dispersed throughout the terrarium and built their own webs. Whether this is the first record of post-emergence maternal care or post-emergence tolerance is uncertain. The spiderlings were not observed to be fed by the female while in the web.

A female collected in Cross the Creek Cave, Bexar County, on 14 Nov. 1995 produced a fertile egg sac on 10 May 1996. Another female collected in Snakeskin Pit, Comal County, on 19 Nov. 1996 produced an egg sac on 7 Jan. 1997. Two virgin females from that egg sac survived in captivity until the first week of Dec. 1998. Sperm storage of up to half a year coupled with a relatively long life span (documented for about two years) could account for the ease in which this spider populates caves. This may also help explain how this species exhibits so much variation in morphological characters. Conceivably, a single female finding access to a new cave via cracks or other interstitial spaces in the soil could result in founding a colony with a genetic bottleneck.

Like *E. pallida*, this species apparently exhibits considerably variation. In Williamson and Burnet counties 8-eyed individuals occur. Those from Comal and Travis counties have the anterior median eyes missing in some specimens and the remaining eyes are reduced in size and none have pigment associated with the eyes. Specimens from Kinney County have the eyes about 1/2 the size of those from more northern counties and those from Uvalde County are essentially eyeless. These are just generally trends as essentially eyeless populations are also known from some caves in Comal County. Throughout the range, the coloration of the body is white to amber and does not appear to be correlated with the size of the eyes. Possibly the

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**Fig. 1.** Mother *Eidmannella rostrata* from Up the Creek Cave, Bexar County, Texas and her two-day-old babies.
coloration is more related to the age of the animal, with older animals being darker. The specimens which have been kept alive in captivity appear to darken with age, but no precise measurements have been made. Because of the incomplete loss of eyes, we assume this is a relatively recent troglobite and it may be for this reason that we are not actually able to distinguish a complex of closely related species. This is mostly the case because in order for an animal to evolve into a troglobite, it must remain isolated underground without a continual influx of genetic material from the surface populations. Once isolated there is no way for genetic exchange between spiders isolated in the different geographically/ geologically isolated regions of the state. All isolated populations would convergently evolve troglomorphic characters which would make them difficult to separate by external morphology. Being isolated, there would not be a need to modify the genitalia, which are in themselves supposedly mechanisms to keep different species from interbreeding and wasting gametes. Hedin (1997) working with eastern USA nesticids from caves found that mtDNA sequence data could resolve morphologically similar lineages into populational phylogenetic units. Hopefully, this approach can be taken with Texas samples in the future.

This species is usually found hanging from webs in small pockets in flowstone or cave walls.


Eidmannella tuckeri, new species

Figs. 2-7

Type data.—The female holotype and immature paratype were collected in Phantom Lake Cave, Jeff Davis County, Texas, October 1996 (W. Tucker). The holotype is deposited at the American Museum of Natural History and the paratype at TMM.

Etymology.—This species is named in honor of the collector, William (Bill) Tucker of Grand Prairie, Texas.

Diagnosis.—Depigmented troglobite with greatly reduced or missing eyes, legs medium length (first leg 5.8 times as long as cephalothorax); epigynum with anterior septum forming a rounded enlargement; median spermathecal bulb elongate and slightly shorter than lateral coils, stalk of median bulb thick.

Description.—Female: Total length 2.23 mm; cephalothorax 1.04 mm long, 0.92 mm wide; abdomen slightly overhanging cephalothorax, 1.20 mm long, 1.03 mm wide; body white; appendages pale yellow without
pattern; without any trace of eyes. Leg formula 1423; first leg 5.8 times, first femur 1.6 times as long as cephalothorax. Appendage lengths Table 1. Epigynum with anterior septum forming a rounded enlargement; in lateral view septum base forming a smooth straight line with anterior portion of epigynal plate; spermatheca with median bulb elongate, terminally enlarged, slightly shorter than lateral coils; lateral coils flattened and slightly twisted.

Immature (presumably male, slightly enlarged palps): Total length 1.52 mm; entire animal white. Differs from holotype by having very small anterior lateral eyes and almost undetectable anterior median eyes; positions of other missing eyes indicated by faint brown pigment.

**Evolution.**—Gertsch (1984) theorized that the various troglobitic species of *Eidmannella* in Texas all evolved from *E. pallida*. *Eidmannella pallida* is found throughout much of the state today, as well as most of North and Central America and the West Indies. Gertsch suggested that this species is very plastic and upon entering caves it would quickly adapt to the environment and develop troglobitic features (depigmentation, loss of eyes, long appendages). He maintained both the surface forms (*suggerens* phenotype) and cavernicolous forms (*pallida* phenotype) were the same species as both the male and female genitalia were essentially the same. Only when he could detect differences in the genitalia of the cave forms were they recognized as full species. If his proposal is correct, *E. tuckeri* might also have evolved from *E. pallida* which invaded the Phantom Spring Cave. This invasion would have been prior to the desertification of the region as no surface *E. pallida* are now known from the Trans-

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**Figs. 2-7.**—Female holotype of *Eidmannella tuckeri*, n. sp.; 2-5 Epigynum: 2, anteroventral view; 3, posterior view; 4, subventral; 5, retrolateral view. 6, ventrolateral view of right spermatheca; 7, retrolateral view of right spermatheca.
Table 1.—Appendage lengths (in mm) of female holotype of Eidmannella tuckeri, new species.

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<th>III</th>
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<td>Tarsus</td>
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<td>4.21</td>
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Pecos region of Texas (Gertsch, 1984: map 8). With this in mind, it is remarkable how similar E. tuckeri is to E. reclusa. Although these two species are on the two extremes of the geographical ranges (E. tuckeri in the west, E. reclusa in the east) of troglobitic Eidmannella in Texas, they share the unique form of the spermathecae (Gertsch, 1984: fig. 290) and the even surface between the anterior portion of the epigynum and the anterior septum. It also seems odd that new cavernicolous species of Eidmannella only developed in Texas caves, but not in any of the other cave populations in North and Central America or the West Indies. Nesticus spp. succeeded at speciation in the caves of North America. If E. pallida is as plastic of a species as suggested by Gertsch, more troglobitic Eidmannella spp. should have developed outside of Texas. When the males of E. tuckeri and E. reclusa are discovered, it will be interesting to see if they both share unique characteristics. We suggest that it is more reasonable to predict that the ancestor(s) to the cavernicolous Eidmannella from Texas invaded the caves before the arrival of Eidmannella pallida. Because of changing climates this ancestor(s) could have then perished on the surface. This is especially true in the three records listed in the introduction where E. pallida and E. rostrata were collected in the same cave. In these cases the E. pallida collected were fully eyed and not some intermediate stage between the two species. In order for Gertsch’s theory to have worked in these two widely separated caves, E. pallida would have had to invade the cave; then evolve into a second species with the elimination of the invading species; and then reinvade the cave with the original eyed species.

Habitat and biology.—Both spiders were obtained within Phantom Spring Cave. Access to the collection area is only possible by diving with scuba gear up the stream into the cave. Bill Tucker (pers. comm., 25 Nov. 1996) reported the following about the collections: “The spiders that I collected were on or near non-descript, irregular-shaped webs. More like random strands of silk instead of webs. The larger one appeared to attack the isopod underwater in the collection container, and was still alive at least one hour later, still underwater. Do you suppose that they regularly feed on underwater critters? They were both found in an air pocket that I have good access to, and can actually stand on the bottom and observe & collect easily there. This is about 160-180’ into the cave, where no light penetrates. There are a few small strands of roots coming down the wall and lying across a horizontal surface that is just about 1’ above the water line. Cave ceiling is at least 6’ above waterline, and one can actually climb out of the water here and continue in dry passage for about 60’. There were several isopods around the roots, and I saw at least one more spider there, but could not say if it was similar to those collected. “Bic” lighter would not burn in this room, so expect oxygen content too low to breathe. In another air pocket, further into the cave, I saw other spiders. Two I remember as being a little darker were within 2” of the waterline, aimed head down on the vertical wall, facing the water.”

ACKNOWLEDGMENTS

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conversations about nesticids and assistance while caving in the Great Smoky Mountains National Park. Specimens listed as JCC are in the personal collection of James Cokendolpher; all other specimens except the types from the American Museum of Natural History are in the Texas Memorial Museum.

**LITERATURE CITED**


