

**FOUR NEW SPECIES OF WATER MITES
OF THE GENUS ARRENURUS FROM MIDDLE
TENNESSEE
(ACARINA: HYDRACARINA)**

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The genus *Arrenurus* is by far the largest of the 247 known genera of water mites, accounting for about one-fifth of the described species. According to Viets (1955, 1956) there are 2800 known species of water mites in the world. He also states that many parts of the world have never been studied and many new species are still being described from areas that are best known. In his catalog of water mites he lists 562 species of arrenuri which are world-wide in distribution. Of these, 452 were described from males, on which the four subgenera are distinguished, and 110 were described from females. Of the males, 143 have been described from Europe, 102 from South America, and 99 from North America.

All of the North American arrenuri have been described by only seven investigators, three of whom were German. The first four North American arrenuri described were by a German worker, Koenike (1895), from material sent to him from Canada. Piersig (1904, 1905) described as new six species which Marshall (1903, 1904) considered to be identical with European species. Paul Munchberg described a new *Arrenurus* from Kentucky in 1951 and in 1953 described another new species from Canada. Of the American workers Ruth Marshall has made the most contributions to our knowledge of water mites. She published 41 papers from 1903 to 1944 in which she described 56 arrenuri. Cook (1954a, 1954b, 1955) described 17 new species from the state of Michigan. Lavers (1945) described 11 new species from the state of Washington. Habeeb (1954, 1957) described three new species of arrenuri, one each from New Jersey, North Carolina, and Canada.

The distribution of North American arrenuri is very poorly known. Lavers (1945) reported 30 species from the state of Washington. Marshall (1940) reported 40 species from Wisconsin. Cook (1954a) reported 63 species from Michigan. No other states have been surveyed with respect to arrenuri but scattered reports indicate most species are widespread geographically with very little known about their ecological requirements.

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Two publications have appeared on Tennessee arrenurids. C. Clayton Hoff (1944a) published on water mites he collected between June 19 and August 10, 1942, while making a study of the microcrustacea of Reelfoot Lake. He listed 42 species of water mites (1944a, 1944b), one of which was described as new. Of these, 14 species were of the genus *Arrenurus*.

Over 550 collections containing over 34,000 water mites have been made since June 1955 in 36 middle Tennessee counties in which over 10,000 male arrenuri were found and examined. In addition to the 14 species collected by Hoff at Reelfoot Lake which were also collected in middle Tennessee, another 16 species were found, four of which are described in this paper as new. The 12 species previously not known from this state are: subgenus *Arrenurus*: *A. fissicornis* Marshall, *A. flabellifer* Marshall, *A. gennadus* Cook, *A. superior* Marshall; subgenus *Megaluracarus*: *A. bartonensis* Cook, *A. cardiacus* Marshall, *A. manubriator* Marshall, *A. megalurus intermedius* Marshall, *A. semicircularis* Piersig; subgenus *Micruracarus*: *A. acutus* Marshall, *A. bicaudatus* Marshall, and *A. lyriger* Marshall. This makes a total of 30 species now known from Tennessee. Collections have not as yet been made in east Tennessee which should add additional species to the list.

Descriptions are now given of four new species of the genus *Arrenurus*, one belonging to the subgenus *Arrenurus* and three belonging to the subgenus *Megaluracarus*.

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Arrenurus (*Arrenurus*) *uniprojectus* n. sp.

Figures 1-4

Description: Male: Based on 84 specimens. (1) Length, including petiole, 1.18-1.29 mm; (2) greatest width 0.68-0.75 mm; (3) least width 0.40-0.44 mm; (4) width between tips of pygal lobes 0.46-0.51 mm; (5) length of petiole 0.15-0.17 mm; (6) greatest width of petiole 0.07-0.09 mm; (7) length from dorsal furrow to tip of pygal lobes 0.79-0.88 mm; (8) width of dorsal shield 0.47-0.53 mm; (9) width between anterior hump glands 0.37-0.43 mm; (10) width between posterior hump glands 0.18-0.20 mm.

Measurements taken, in millimeters, on five specimens are as follows (numbers in parenthesis refer to the type of measurement as given above):

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Type
1.26	0.73	0.43	0.50	0.16	0.08	0.85	0.50	0.40	0.20	Type
1.18	0.68	0.40	0.48	0.15	0.08	0.79	0.47	0.41	0.19	Paratype
1.25	0.72	0.43	0.50	0.16	0.08	0.84	0.50	0.42	0.20	Paratype
1.27	0.72	0.41	0.47	0.16	0.08	0.84	0.50	0.42	0.19	Paratype
1.29	0.73	0.43	0.50	0.16	0.08	0.85	0.51	0.42	0.19	Paratype

Anterior one-third of body broadly rounded with slight bulging in front of each eye. Two small, round projections at anterior tip containing pigmented spots (accessory eyes?) between which is a smooth rounded

concavity. Sides of body roughly parallel along middle one-third, tapering slightly anteriorly. Greatest width near middle of body and least width at junction of pygal lobes and body. Pygal lobes project dorsolaterally, having about same greatest width as dorsal shield, making body appear much wider than cauda. A pair of dorsally projecting humps occur anteriorly, each one anterior and lateral to dorsal shield. Dorsal shield with single, high, rounded dorsal hump which at its apex is twice as wide as long. A gland occurs slightly posterior to each lateral apex of hump and a pair of setae occur on anterior side of hump. Petiole tubular, widest near middle where dorsally projecting bristle arises on each side; with wing-like medial extensions at dorsal tip and single dorsally projecting subterminal process. Peg-like process arising on cauda projects ventroposteriorly into cavity of petiole. Anterior to petiole on cauda are two depressions separated by a peculiar projection, which has a thick base that becomes abruptly narrow posteriorly and then flattens out at end. On lateral edge of each depression is a small dorsomedially projecting process. Anterior and medial to depressions are a pair of dorsally projecting bristles. Hyaline appendage has a peculiar shape with central portion depressed and lateral portions tubular and curved dorsally. On each side of petiole the cauda projects past base of petiole, each projection bearing a bristle. Two long setae arise on ventral tip of cauda. Each pygal lobe bears a single subterminal seta. Dorsal furrows end on posteroventral sides of pygal lobes. Acetabular plates extend half way up lateral sides and can be seen from dorsal view. Three long setae, which are easily seen from dorsal view, arise laterally along posterior edge of each acetabular plate. A gland occurs dorsoanteriorly to each acetabular plate. Palp segment two with one thick dorsal, one thick lateral, and one thick and three slender medial setae. Segment three with one slender medial seta.

Holotype: Adult male, collected from Ridgetop Lake, Robertson County, Tennessee, $1\frac{1}{2}$ miles north of Roberson-Davidson County line and U. S. highway 41 near Ridgetop, Tennessee on June 16, 1958. Holotype to be deposited in the Chicago Natural History Museum.

Paratypes: 18 males, same date and locality as holotype; 18 males, same locality on August 28, 1957; 42 males, same locality on May 13, 1958; 5 males, same locality on June 11, 1958. Paratypes to be deposited in the Chicago Natural History Museum, United States National Museum, and in writer's collection.

Habitat: Found in shallow areas of the lake in heavy vegetation, especially *Chara* and water lilies.

Range: Known only from type locality.

Remarks: *Arrenurus uniprojectus* is similar to the "superior" group as characterized by Cook (1954a) which includes *A. superior* Marshall, *A. pseudosuperior* Cook, *A. neosuperior* Cook, *A. amplius* Marshall, *A. platyrotundo-cuspidator* Munchberg, *A. magnicaudatus* Marshall, *A. maryellenae* Cook, and *A. wallensis* Cook. He characterized this group as having a single dorsal hump, tubular petiole open dorsally with a keel on the ventral side of the inner surface, and a very small somewhat pointed hyaline appendage.

A. uniprojectus is like the "superior" group by having a single dorsal hump, a tubular petiole open dorsally but no keel is present although a small subterminal process does arise from the ventral side of the inner surface. The hyaline appendage is also small and pointed but differs in having two lateral points which project dorsally rather than a single median point projecting posteriorly. It also differs from this group by being much smaller and having the cauda much narrower than the body proper.

A. uniprojectus is similar in dorsal view to a South American form, *A. rectipetiolatus*, as shown by Lundblad (1944), but structures on the cauda as well as petiole are quite different. The diagram of the palp is very similar even to number and location of setae.

This species differs from all other North American species by having a pair of dorsally projecting lateral bristles located about midway on the petiole, by having a pair of pigmented spots anteriorly which appear to be accessory eyes, and by having a posterodorsally projecting process near the end of the cauda on which the specific name is based.

Arrenurus (Megaluracarus) falcicaudatus n. sp.

Figures 5-7

Description: Male: Based on 13 specimens. (1) Length 1.02-1.14 mm; (2) width 0.57-0.67 mm; (3) approximate length of cauda 0.35-0.41 mm; (4) width of cauda 0.26-0.30 mm; (5) length from dorsal furrow to end of cauda 0.85-0.93 mm; (6) width of dorsal shield 0.40-0.49 mm.

Measurements taken, in millimeters, on five specimens are as follows (numbers in parenthesis refer to the type of measurement as given above):

(1)	(2)	(3)	(4)	(5)	(6)	
1.10	0.63	0.37	0.30	0.93	0.45	Type
1.02	0.57	0.36	0.26	0.85	0.40	Paratype
1.09	0.62	0.36	0.28	0.89	0.44	Paratype
1.11	0.63	0.38	0.28	0.89	0.44	Paratype
1.14	0.67	0.41	0.28	0.93	0.49	Paratype

Body broadly oval, widest just anterior to mid-region; approximately straight between eyes but slightly depressed posterolaterally to each eye. When tilted backwards, anterior end appears somewhat more pointed than is shown in figure 6. Cauda somewhat broadly joined to body being only slightly constricted at junction with body. From a lateral view cauda is seen to curve dorsally. A very small projection or petiole, almost disappearing in some specimens, may be seen in slight medial indentation at end of cauda. A pair of very small posterolateral processes curve dorsally on cauda forming a very slight depression medially. Anterior to depression are a pair of small elevations, each bearing a sharp pointed process posteromedially. Slight humps occur at widest portion of body from which body goes straight posteroventrally. Dorsal furrows terminate ventrally on cauda and posterior to each is a small gland. Acetabular plates are broad and may be seen from dorsal view. Just dorsal to each acetabular plate is a small gland. Palp segment two with one long lateral, one long dorsal, and one long and three short medial setae. Segment three with one long medial seta and one lateral seta. Segment four appears to have one seta on dorso-proximal edge but this seta may be attached to distal end of segment three.

Holotype: Adult male, collected from a dammed-up portion of spring-fed Turner Creek north of U. S. highway 70 at Pegram, Tennessee, one-half mile west of Cheatham-Davidson County line in Cheatham County on April 24, 1956. Holotype to be deposited in the Chicago Natural History Museum.

Paratypes: One male, same date and locality as holotype; one male, same locality on September 21, 1955; two males, same locality on November 5, 1955; one male, same locality on December 2, 1955; one male, same locality on March 29, 1956; four males, same locality on April 14, 1956; one male, same locality on May 30, 1956; one male, same locality on June 29, 1956. Paratypes to be deposited in the Chicago Natural History Museum, United States National Museum, and in writer's collection.

Habitat: *Chara* and other vegetation in a dammed-up portion of the spring-fed creek.

Range: Known only from type locality.

Remarks: *A. falcicaudatus* resembles *A. laversi* Marshall, 1944, a species described from specimens collected from mountain waters near Seattle, Washington. The two species are similar in body shape from a dorsal view with *A. laversi* being somewhat wider at the anterior tip. The two caudas

are also much alike from a dorsal view differing mainly in length. The cauda of *A. falcicaudatus* is only about one-third the body length as compared to two-thirds in *A. laversi*. The palps of the two are also very similar. *A. falcicaudatus* differs mainly from *A. laversi* in the lateral view of the cauda, which in the former is smoothly rounded to the posterior end and hence does not have the small hump present in the latter. The smoothly dorsally-curving cauda suggested the specific name for this species.

Arrenurus (Megaluracarus) unisinuatus n. sp.

Figures 8-10

Description: Male: Based on two specimens. (1) Length 0.87 mm; (2) width 0.48-0.49 mm; (3) approximate length of cauda 0.34 mm; (4) width of cauda 0.21-0.22 mm; (5) length from dorsal furrow to end of cauda 0.72-0.73 mm; (6) width of dorsal shield 0.33-0.34 mm.

Measurements, in millimeters, on the two specimens found are given below (numbers in parenthesis refer to the type of measurement as given above):

(1)	(2)	(3)	(4)	(5)	(6)	
0.87	0.49	0.34	0.22	0.73	0.34	Type
0.87	0.48	0.34	0.21	0.72	0.33	Paratype

Anterior portion of body slightly indented medially between eyes and posterior to each eye laterally. Broadest portion of body anterior to mid-region on which is a slight hump laterally. Posterolateral portions of body curve in sharply. Dorsal furrows terminate on ventral side of cauda and posterior to each is a small gland. From dorsal view cauda is smoothly curved to posterior tip where it curves back anteriorly to form a rounded bay. On ventral side of cauda at anterior edge of bay is a tiny petiole not easily seen dorsally. Posterolateral edges of cauda curve dorsally forming a depression medially. Anterior to depression are two small medial elevations. A smoothly-rounded dorsal hump occurs on cauda. Acetabular plates broad and easily seen from dorsal view. Palp segment two with one long lateral, one long dorsal, and one long and three short medial setae. Segment three with one long lateral seta.

Holotype: Adult male, collected from Calfkiller River 100 yards north of Tennessee highway 26 in Sparta, White County, Tennessee, on September 14, 1955. Holotype to be deposited in the Chicago Natural History Museum.

Paratype: One male, same date and locality as holotype. Paratype will remain in writer's collection.

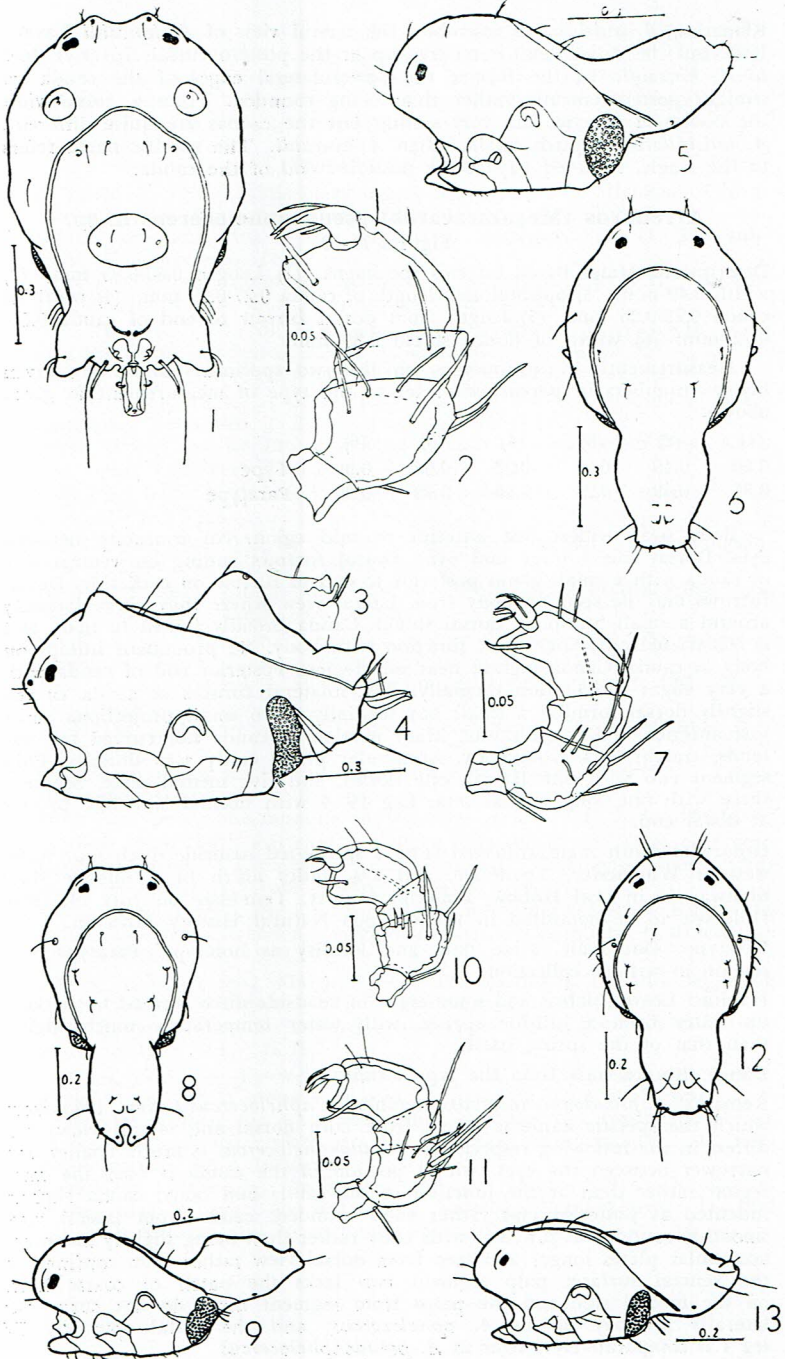
Habitat: Found only at a steep bank of the small river in leaves and debris. The water was slow moving and somewhat muddy.

Range: Known only from the type locality.

EXPLANATION OF PLATE

All scales in mm

- Figure 1. *Arrenurus uniprojectus*, dorsal view.
 Figure 2. *A. uniprojectus*, medial view of right palp.
 Figure 3. *A. uniprojectus*, lateral view of tip of cauda with pygal lobe removed.
 Figure 4. *A. uniprojectus*, lateral view.
 Figure 5. *A. falcicaudatus*, lateral view.
 Figure 6. *A. falcicaudatus*, dorsal view.
 Figure 7. *A. falcicaudatus*, medial view of right palp.
 Figure 8. *A. unisinuatus*, dorsal view.
 Figure 9. *A. unisinuatus*, lateral view.
 Figure 10. *A. unisinuatus*, medial view of right palp.
 Figure 11. *A. pseudoaphelocercus*, medial view of right palp.
 Figure 12. *A. pseudoaphelocercus*, dorsal view.
 Figure 13. *A. pseudoaphelocercus*, lateral view.



Remarks: *A. unisinuatus* resembles the lateral view of *A. kincaidi* Lavers, 1945, but the cauda does not curve up at the posteroventral tip as it does in *A. kincaidi*. In the former the posterolateral edges of the cauda go straight posteroventrally rather than being rounded. From a dorsal view the bodies of the two are very similar but the caudas are quite different. *A. unisinuatus* is much smaller than *A. kincaidi*. The specific name refers to the single, rounded bay at the posterior end of the cauda.

***Arrenurus (Megaluracarus) pseudoaphelocercus* n. sp.**

Figures 11-13

Description: Male: Based on two specimens. (1) Length 0.80-0.85 mm; (2) width 0.49 mm; (3) approximate length of cauda 0.27-0.29 mm; (4) width of cauda 0.23-0.26 mm; (5) length from dorsal furrow to end of cauda 0.68-0.72 mm; (6) width of dorsal shield 0.39 mm.

Measurements, in millimeters, on the two specimens found are given below (numbers in parenthesis refer to the type of measurement as given above):

(1)	(2)	(3)	(4)	(5)	(6)	
0.80	0.49	0.27	0.23	0.68	0.39	Type
0.85	0.49	0.29	0.26	0.72	0.39	Paratype

Body oval, widest just anterior to mid-region. No concavity between eyes. Dorsal shield large and oval. Dorsal furrows ending on ventral side of cauda with a small gland posterior to end of furrow on each side. Dorsal furrows may be seen on body from lateral view where they curve laterally around a small hump on dorsal shield. Cauda broadly joined to body and is constricted only slightly at junction with body. No prominent humps on body or cauda. Cauda highest near mid-region. Posterior end of cauda with a very slight indentation medially. Posterolateral corners of cauda curved slightly dorsal forming a small bay medially. Two small projections occur just anterior to bay on cauda. Main portion of cauda not curved but extends straight back from body. Acetabular plates easily seen dorsally. Palp segment two with one lateral, one dorsal, and five medial setae. Segment three with one long medial seta. Leg IV 4 with normal spur-like process at distal end.

Holotype: Adult male, collected from a spring-fed roadside ditch four miles west of Winchester, Tennessee, and 1½ miles north of Tennessee state highway 50 in Owl Hollow, Franklin County, Tennessee on July 14, 1956. Holotype to be deposited in the Chicago Natural History Museum.

Paratype: One male, same date and locality as holotype. Paratype will remain in writer's collection.

Habitat: Leaves, debris and some algae in roadside ditch formed by backed-up water from a hillside spring, with water temperature much higher than that of the spring itself.

Range: Known only from the type locality.

Remarks: *A. pseudoaphelocercus* resembles *A. aphelocercus* Lavers, 1945, from which the specific name is taken, from both dorsal and lateral views but differs in the following respects: *A. pseudoaphelocercus* is much smaller and narrower between the eyes; widest portion of the cauda is near the mid-region rather than at the junction of the cauda and body; cauda slightly indented at posterior end rather than rounded; cauda from lateral view smoothly rounded at junction with body rather than being slightly indented; acetabular plates longer and seen from dorsal view rather than confined to the ventral surface; palp segment two lacks the patch of coarse hairs on the medial side and the palps from segment three do not curve out laterally as they do in *A. aphelocercus*; and the distal spur on IV leg 4 is comparatively longer in *A. pseudoaphelocercus*.

A. pseudoaphelocercus also resembles *A. medio-rotundatus* Thor, 1898, as shown by Viets (1936, p. 436, fig. 493b) but differs in that *A. pseudoaphelocercus* is somewhat more constricted laterally near the posterior end of the cauda, as well as having the slight indentation medially at the posterior tip of the cauda which is not present in *A. medio-rotundatus*.

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