

## HOST SPECIFICITY OF MISTLETOE IN MIDDLE TENNESSEE V: WILLIAMSON COUNTY

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### ABSTRACT

A total of seventy-four deciduous trees, all native angiosperms belonging to eleven species and nine genera, were found to be parasitized by *Phoradendron flavescens* in Williamson County, Tennessee. The most commonly infested trees were *Ulmus serotina* (66%) and *U. americana* (11%). Comparisons were made between the host specificity, distribution and density of mistletoe in this county and that of previously surveyed areas.

### INTRODUCTION

American mistletoe, *Phoradendron flavescens* (Pursh) Nutt. (Loranthaceae), a semi-parasite of arboreal angiosperms, is restricted to North America. Its geographical range includes the eastern deciduous forest from southeastern Oklahoma and Missouri, eastern Texas, the extreme southern portion of Illinois, Indiana, and Ohio, southeastern Pennsylvania and New Jersey, southwards to the Gulf Coast (Weins 1964).

However, in each locality in which studies have been conducted, it parasitizes only certain tree species. For example, *Ulmus americana* was the most commonly infested tree in several counties of the Central Basin of Tennessee, including Rutherford, 38% (Rucker and Hemmerly 1976), Maury, 44% (Ferguson and Hemmerly 1976) and Davidson, 49% (McKinney and Hemmerly 1977). In contrast, Brown and Hemmerly (1979) found *Carya ovata* to be the most common host (41%) in Bedford County, also within the Basin. In Lawrence County, located within the southwestern portion of the Highland Rim which surrounds the Basin, 90% of the parasitized trees were *Nyssa sylvatica* (Hemmerly, Forsythe and Womack 1979).

Among the counties of the Central Basin which have not been surveyed for mistletoe hosts is Williamson. It is located principally within the west-central portion of the Basin. However, the extreme northwest portion lies along the eastern edge of the Western Highland Rim. The purpose of this study was to sample representative areas of the county, including both the Basin and Rim portions, for mistletoe hosts. The destruction of natural ecosystems as the result of increasing human population expansion from metropolitan Nashville-Davidson County (directly to the north) gives increased impetus to such biological surveys.

### METHODS AND RESULTS

Sightings of mistletoe-infested trees were made in Williamson County during late April and early May, 1978. Approximately 218 kilometers of paved and un-

paved roads, chosen to include all major portions of the county, were traveled by automobile. Records were kept separately for the Basin and Rim regions of the county.

Identifications of infected trees were made in their winter conditions, using keys by Harlow (1954), Brockman (1968) and Wharton and Barbour (1973).

In the Basin portion of the county, a total of seventy-one mistletoe-infested trees were observed (Table 1); eleven species of nine genera are included. The genus *Ulmus* accounts for more than three-fourths (78%) of the total, with *U. serotina* the most common (66%) host. Each of the remaining nine species contributed less than five percent of the total.

TABLE 1. Occurrence of mistletoe-infested trees in the Central Basin portion of Williamson County, Tennessee.

Species	No. of Trees	% of Total
1. <i>Carya illinoensis</i> (Wang) K. Koch	1	1.4
2. <i>C. ovata</i> (Mill.) K. Koch	2	2.8
3. <i>Diospyros virginiana</i> L.	2	2.8
4. <i>Fraxinus americana</i> L.	2	2.8
5. <i>Juglans nigra</i> L.	2	2.8
6. <i>Maclura pomifera</i> (Raf.) Schneid.	1	1.4
7. <i>Nyssa sylvatica</i> Marsh.	1	1.4
8. <i>Prunus serotina</i> Ehrh.	2	2.8
9. <i>Robinia pseudo-acacia</i> L.	3	4.2
10. <i>Ulmus americana</i> L.	8	11.3
11. <i>U. serotina</i> Sarg.	47	66.3
TOTALS	71	100.0

On the Rim of Williamson County, three host trees were located, all *Nyssa sylvatica*.

The distribution of host trees was uneven; greater numbers occurred in the central and eastern portions of the county. No parasitized trees were sighted in either of the Basin urban area, Brentwood (north) or Franklin (central); however, all three *Nyssa sylvatica* host trees were located in the Fairview community which is near the center of the Rim area of the county.

The degree of infestation ranged from a single mistletoe clump to the approximately seventy-five clumps observed in a single specimen of *Ulmus serotina*. In fact, trees of this species were found to be heavily parasitized more often than those of any other.

### DISCUSSION AND CONCLUSIONS

Williamson County borders three other Central Basin counties in which mistletoe surveys have been conducted: Davidson (McKinney and Hemmerly 1977),

Rutherford (Rucker and Hemmerly 1976) and Maury (Ferguson and Hemmerly 1976). As in each of these counties, *Ulmus* is the best represented genus. However, the most common species, *U. serotina*, in Williamson County, contrasts with *U. americana*, the most common in the other three counties. In this regard, observations made during this field study of Williamson County indicated that the number of total trees (parasitized or non-parasitized) of *U. americana*, *U. rubra*, and *U. serotina* was approximately equal. Thus, the greater incidence of parasitized trees of *U. serotina* than *U. americana*, and the absence of any sightings of mistletoe-infested *U. rubra* illustrates two principles established by previous studies: (1) in a given geographic area, some species, even taxonomically closely related ones, are more mistletoe-susceptible than others, and (2) mistletoe attacks different host trees in different areas.

The density of mistletoe-infected trees in Williamson County is comparable to that of other recently surveyed areas. The ratio of kilometers traveled (218) to the number of host trees sighted (74), or 0.34 trees per kilometer, compares to ratios of 0.33 for Bedford County in the Basin (Brown and Hemmerly 1979), 0.44 for Lawrence County on the Rim (Hemmerly, Forsythe and Womack 1979), and 0.52 for Walker County in northwest Georgia (Cole and Hemmerly 1980, unpublished manuscript). These density comparisons are consistent with the hypothesis suggested in the last reference cited above, namely that mistletoe density correlates positively with annual rainfall.

The occurrence of mistletoe-parasitized *Nyssa sylvatica* principally within the Rim portion of Williamson County would suggest the prevalence of this species as a mistletoe host on the central portion of the western Highland Rim as was also the case on the southwestern Highland Rim (Hemmerly, Forsythe and Womack 1979).

It can be concluded the American mistletoe is a fairly frequent parasite of various arboreal hosts in Williamson County, Tennessee. As determined by previous studies, it: (1) is found almost exclusively on native trees, all of which are deciduous angiosperms, (2) demonstrates a distinct host preference, parasitizing a few species commonly, others rarely and many not at all, and (3) shows a different affinity for hosts on the Highland Rim as compared to the Central Basin of middle Tennessee.

#### ACKNOWLEDGMENTS

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## TWO NEW SPECIES OF WATER MITES (ACARINA: ARRENURIDAE, GENUS ARRENURUS, SUBGENUS MICRURACARUS) WITH REDESCRIPTIONS OF TWO CLOSELY RELATED SPECIES.

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#### ABSTRACT

Two new species of water mites of the genus *Arrenurus*, subgenus *Micruracarus*, are described. *Arrenurus avicaputus* is described from specimens taken in Robertson County, Tennessee and Wayne County, Georgia. *Arrenurus stenochondrus* is described from specimens taken in Shelby and Obion (perhaps Lake)

counties in Tennessee and Ascension Parish in Louisiana. Due to incomplete descriptions and diagrams which resulted in misclassifications both *Arrenurus ly-riger* Marshall, 1908 and *Arrenurus muttkowskii* Marshall, 1940 are redescribed. A new key to species of the subgenus *Micruracarus* in Tennessee is included due to the addition of two new species and previous misclassifications.

## INTRODUCTION

The subgenus *Micruracarus* has the least number of species in Tennessee (now at eight) of the three subgenera of *Arrenurus* (a fourth subgenus occurring in North America, *Truncaturus*, has not yet been collected in Tennessee). Two of the eight species (*Arrenurus acutus* Marshall, 1908 and *Arrenurus bicaudatus* Marshall, 1908) still present a problem that may be resolved in the future with additional collections. At this time Tennessee specimens of these two species can be separated only on size, with no morphological differences noted (see discussion on pp. 206-8, Wilson, 1961).

After close examination of museum specimens it was noted that two errors of identification in the subgenus *Micruracarus* were made in my 1961 paper. *Arrenurus lyriger*, erroneously reported and described on pp. 210-211 turns out to be *A. muttkowskii*. *Arrenurus muttkowskii*, erroneously reported and described on pp. 211-12, turns out to be a new species, described in this paper as *A. avicaputus*. This deletes *A. lyriger* from the list of species reported from Tennessee. However, it is probable that it does occur in Tennessee since Marshall reported it being collected from central Missouri, a state adjacent to Tennessee. For that reason it is included in the subgeneric key. In the process of re-examination of my own specimens and of those sent to me from the museum, three specimens were found that belong to still another new species, described in this paper as *A. stenochondrus*. Two specimens were part of a museum collection of six male specimens identified as *A. muttkowskii* by C. Clayton Hoff in 1942 from Reelfoot Lake. Hoff (1944) indicated he was not positive of the identification by only 'tentatively' assigning them to *A. muttkowskii* based on Marshall's 1940 description. One other specimen was found in a collection from Shelby County (also in West Tennessee south of Reelfoot Lake) that was mixed in with specimens I had misidentified as *A. lyriger*. In addition to the above three specimens, five specimens of the new species *A. stenochondrus* were collected in south-east Louisiana.

The diagnosis of males of the subgenus *Micruracarus* usually include the following characteristics: Cauda rather short and usually well-developed, with a postero-medial cleft or notch; petiole, if present, rudimentary or well developed and sometimes quite complex with finned to dorsal surface or passing onto sides of body. associated hyaline structures; dorsal furrow either confined to dorsal surface or passing onto sides of body. The species in Tennessee of this subgenus divide rather easily into two groups. Group I is characterized by an incomplete dorsal furrow. Group II is characterized

by a complete dorsal furrow and a petiole attached to the dorsal shield by a sclerotized bridge. Some species of group I occurring in other states may have a petiole, which, when present, is attached directly to the dorsal shield. The three species in Tennessee belonging to group I are *A. acutus*, *A. bicaudatus*, and *A. quadrisemiluniatius*. The five species in Tennessee belonging to group II are *A. avicaputus*, *A. infundibularis*, *A. laticaudatus*, *A. muttkowskii*, and *A. stenochondrus* (*A. lyriger*, not yet reported in Tennessee, also belongs to group II).

## KEY TO MALES OF THE SUBGENUS MICRURACARUS OF TENNESSEE

1. Petiole absent ..... 2  
Petiole well developed ..... 4
2. Dorsal furrow passing onto sides of cauda ..... 3  
Dorsal furrow confined to dorsal surface—*A. quadrisemiluniatius* Wilson
3. Length 0.74 mm or less ..... *A. bicaudatus* Marshall  
Length 0.81 mm or over ..... *A. acutus* Marshall
4. Cauda not as wide as body proper ..... 5  
Cauda wider than body proper ..... *A. laticaudatus* Marshall
5. Bulge over each eye with small rounded projection anteriorly ..... 6  
Bulge over each eye without small rounded projection anteriorly ..... *A. infundibularis* Marshall
6. Dorsal shield somewhat heart-shaped, widest anterior to mid-region ..... 7  
Dorsal shield squarish to rectangular in shape ..... 8
7. Petiole lyre-shaped, cauda somewhat constricted at its base....  
(not yet found in Tennessee) *A. lyriger* Marshall  
Petiole not lyre-shaped (in preserved specimens leans to right side), cauda only slightly constricted at its base....  
..... *A. muttkowskii* Marshall
8. Dorsal shield much wider than long, widest posterior to mid-region, with anterolateral concavities .....  
..... *A. avicaputus* n. sp.  
Dorsal shield usually appears slightly wider than long, widest near mid-region ..... *A. stenochondrus* n. sp.

## DESCRIPTIONS

Diagrams of the two new species (and the two redescriptions) do not include the legs since these are much alike throughout the genus. Five diagrams are included for each species: dorsal view, lateral view, median view of right palp, and a dorsal and lateral view of the dorsal shield with attached sclerotized bridge and petiole with surrounding hyaline structures. This author feels that future descriptions and diagrams of new species to be included in group II of this subgenus should include the latter two diagrams for several reasons: (1) in the dorsal view it is difficult to distinguish between the petiole with its hyaline structures and the structures of the cauda, (2) the anterior hinge attachment of the dorsal shield seems to be distinct, and (3) the lateral view of the sclerotized bridge seems to be quite unique. The one disadvantage is that the specimen has to be dissected. However, future descriptions of new species might be much clearer should these diagrams be included. In the two new species measurements for the holotype are given first followed by the range of size variations of the paratype series in parentheses. Holotypes will be deposited in the Field Museum of Natural History (Chicago).

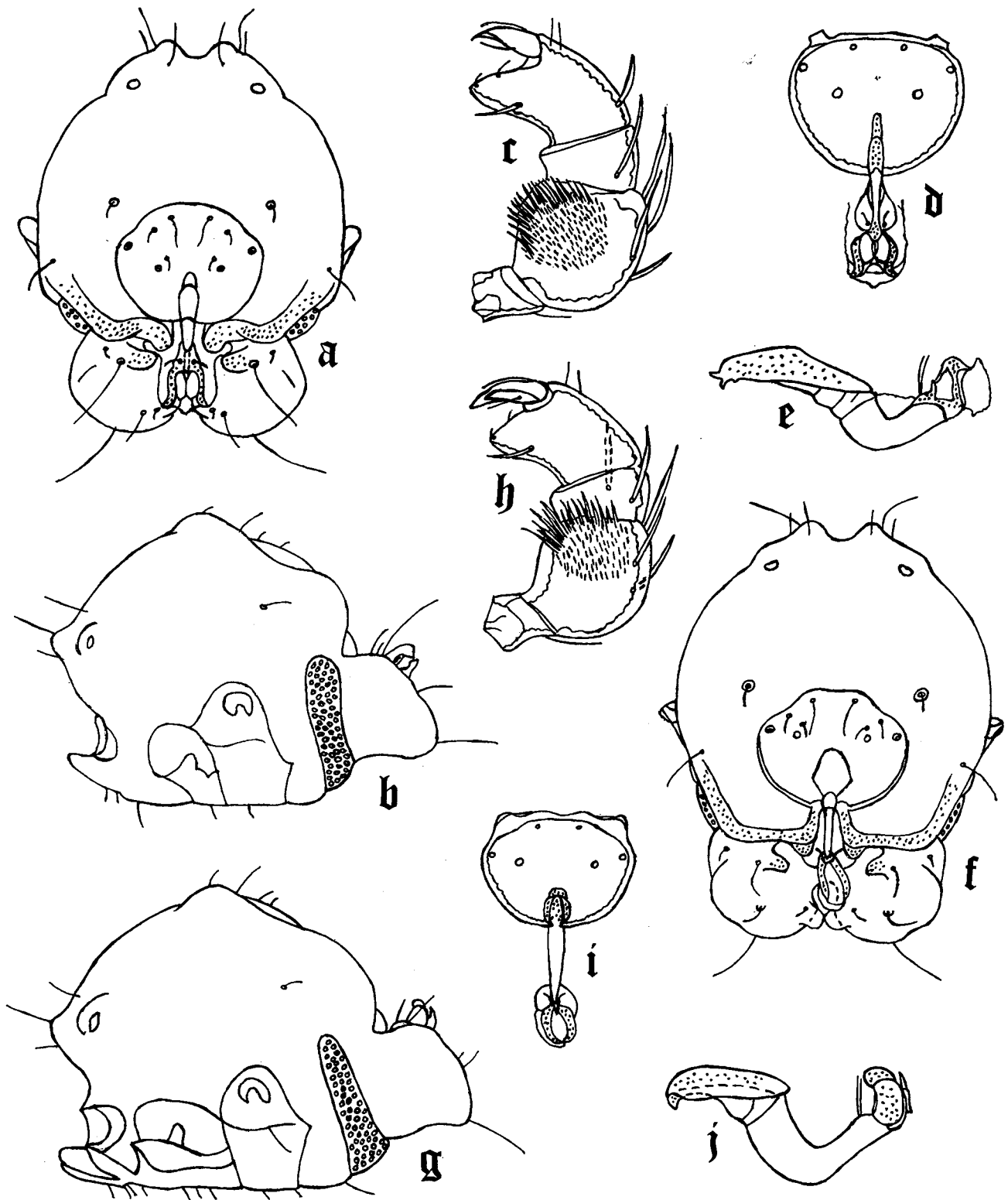


FIG. 1: Dorsal and lateral view of body, median view of right palp, and dorsal and lateral view of dorsal shield, respectively of two new species of water mites. *Arrenurus avicaputus* n. sp., male, a-e. *Arrenurus stenochondrus* n. sp., male, f-j.

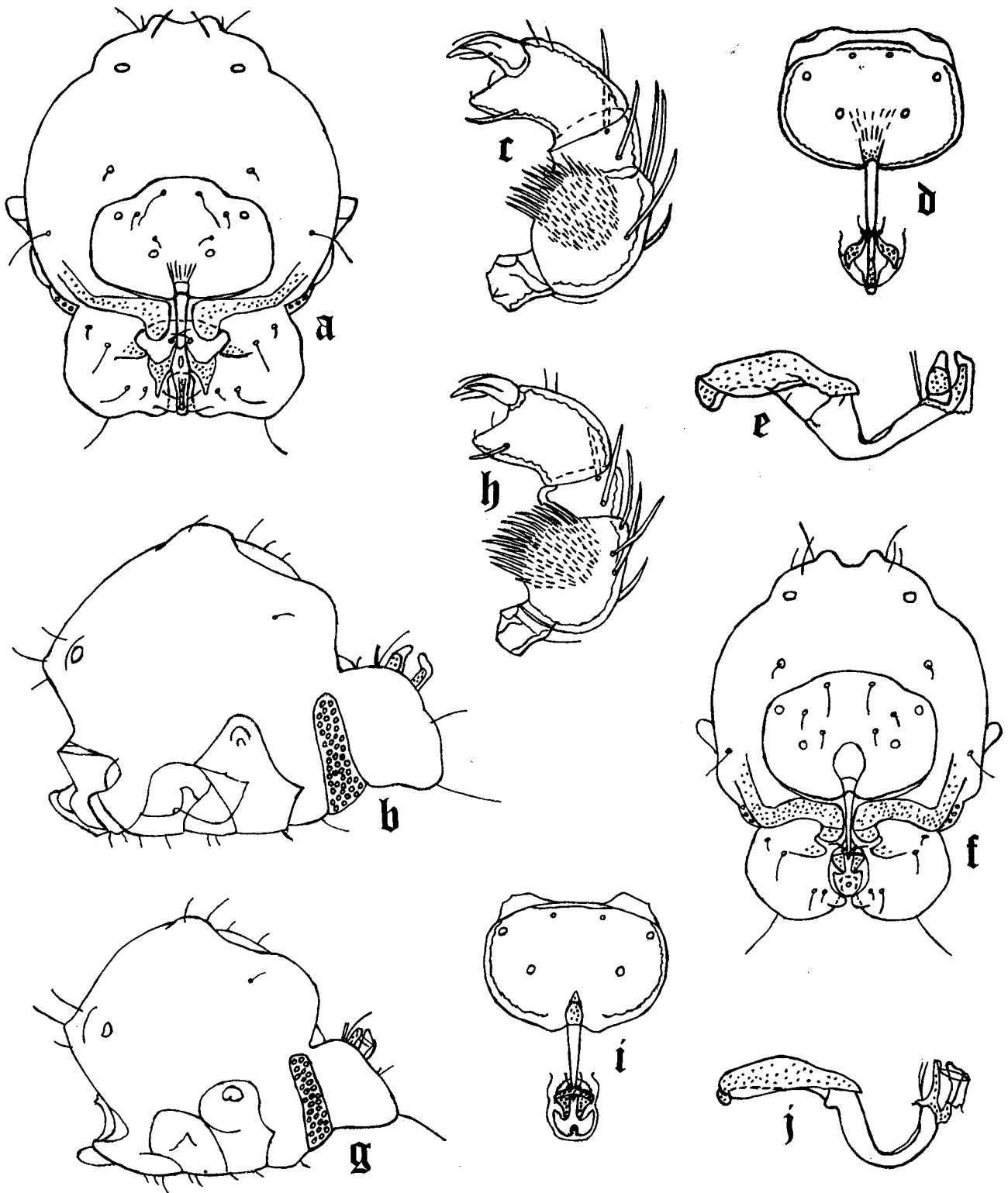


FIG. 2: Dorsal and lateral view of body, median view of right palp, and dorsal and lateral view of dorsal shield, respectively of two redescribed species of water mites. *Arrenurus lyriger* Marshall, male, a-e. *Arrenurus muttkowskii* Marshall, male, f-j.

## ARRENERUS AVICAPUTUS, NEW SPECIES

**DESCRIPTION:** Male: (See Figures 1a-e) Based on 19 specimens. Length 0.93 mm. (0.92-0.99 mm.); width 0.70 mm. (0.70-0.78 mm.); length of cauda 0.25 mm. (0.23-0.26 mm.); width of cauda 0.54 mm. (0.54-0.59 mm.); length of dorsal shield 0.32 mm. (0.28-0.33 mm.); width of dorsal shield 0.44 mm. (0.41-0.45 mm.).

Body proper almost circular in outline, widest near mid-region; with a bulge over each eye, with each bulge having a small rounded projection anteriorly between which is a slight concavity; dorsally projecting humps (best seen laterally) near mid-region; dorsal shield much wider than long with widest area slightly posterior to mid-region, with anterolateral concavities (due to closeness of dorsally projecting body humps), bearing two pairs of glandularia, one pair of long setae anteriorly and two pairs of short setae; dorsal furrow complete and restricted to dorsal surface; cauda much wider than long, shape varying slightly among specimens observed, especially the lateral edges (as seen dorsally), which appear rounded in some and slightly indented (as in Figure 1a) in others, posterolateral corners slightly rounded medial to which the cauda is slightly indented ending medially in rounded projections extending anteriorly to form a somewhat U-shaped cleft (best seen ventrally) dividing cauda into two lobes, posteromedial area of lobes bear dorsomedially projecting rounded humps which, in most specimens, touch medially, one pair of dorsomedially projecting rounded (pointed in some) humps on anterior portion of cauda, each lobe of cauda with three long and two short setae; dorsoposterior area of ventral shield rounded laterally, with medial area having two rounded projections extending posteroventrally over cauda; petiole attached to dorsal shield by sclerotized bridge (see Figures 1d and e), bridge as seen laterally quite thick anteriorly becoming much thinner in the ventral curved portion, petiole complex, in three parts, two lateral parts thick at the base ending in sharp points, with posterior part more uniform with blunt end (two lateral parts vary in specimens observed with projecting points extending dorsally in some and more lateral in others), petiole surrounded by complex hyaline structure, especially posterior part from which it extends ventrally and anteriorly around bases of two lateral parts attaching anteriorly (lateral view of posterior part of petiole, see figure 1e, with surrounding hyaline structure resembles a bird's head, suggested name *avicaputus*), a pair of dorsally projecting setae occur at junction of bridge with petiole; acetabular plates extending far up the sides of the body; palp (see Figure 1c) with several long setae, medial surface of palp segment two with a patch of numerous setae; third and fourth legs with numerous swimming hairs while those on the first and second legs fewer in number.

**HOLOTYPE:** Adult male, collected from Ridgetop Lake, one mile north of Robertson-Davidson County line and U.S. 41, in Robertson County Tennessee, May 28, 1959.

**PARATYPES:** Five males, same date and locality as holotype; three males, same locality as holotype, August 28, 1957; eight males, same locality as holotype, June 16, 1958; one male, same locality as holotype, May 12, 1961; one male, from swampy area beside U.S. 25, five miles northeast of Jesup, Wayne County, Georgia, August 2, 1963.

**HABITAT:** Water lilies, algae, and other water vegetation in permanent lakes and swampy areas.

**RANGE:** Known only from one lake in Robertson County, Tennessee and a swampy area in Wayne County, Georgia.

**DISCUSSION:** This new species differs from other closely related species in the following set of characteristics: (1) dorsal shield much wider than long with widest area slightly posterior to mid-region, (2) posteromedial area of caudal lobes bear dorsomedially projecting rounded humps which, in most specimens, touch medially, (3) sclerotized bridge, attaching the petiole to ventral side of dorsal shield, quite thick anteriorly (as seen from lateral view) becoming much thinner in the ventral curved portion, and (4) three parts of petiole quite distinct in shape, with two lateral parts thick at base ending in sharp points, with posterior part surrounded by a hyaline structure, which, when viewed laterally, resembles a bird's head. It should be noted that the two lateral, sharp pointed

portions of petiole vary somewhat in position when comparing specimens. If the petiole is depressed ventrally the pointed portions tend to be directed posteriorly, whereas in other specimens where the petiole is more dorsal in position, the pointed portions tend to be directed laterally. The different positions of the petiole is explained by the way the dorsal shield (with the ventrally attached sclerotized bridge and petiole) is attached to the ventral shield. The attachment of the dorsal shield is by a hinge-like structure along the anterior border only, allowing the posterior edge of the dorsal shield to move dorsoventrally.

## ARRENERUS STENOCHONDRIUS, NEW SPECIES

**DESCRIPTION:** Male: (See Figures 1f-j) Based on 8 specimens. Length 1.01 mm. (0.90-1.02 mm.); width 0.75 mm. (0.71-0.75 mm.); length of cauda 0.22 mm. (0.21-0.24 mm.); width of cauda 0.55 mm. (0.52-0.59 mm.); length of dorsal shield 0.36 mm. (0.32-0.36 mm.); width of dorsal shield 0.44 mm. (0.39-0.44 mm.).

Body proper almost circular in outline, widest near mid-region with posterolateral bulges just anterior to acetabular plates; with a bulge over each eye, with each bulge having a small rounded projection anteriorly between which is a concavity (depth varies some); dorsally projecting humps (best seen laterally) near mid-region; dorsal shield wider than long, appearance dorsally variable from rectangular to squarish in shape, bearing two pairs of glandularia, one pair of long setae anteriorly and two pairs of short setae; dorsal furrow complete and restricted to dorsal surface; cauda much wider than long, somewhat constricted at its base, with mostly rounded corners, median notch or cleft (best seen in ventral view) separates cauda into two lobes, posteromedial area of lobes bear dorsomedially projecting rounded humps which do not touch medially, one pair of dorsomedially projecting rounded (pointed in some) humps on anterior portion of cauda, each lobe of cauda with three long and two short setae; dorsoposterior area of ventral shield with distinct rounded corners laterally from which they curve in medially (amount of anterior curving varies) to form two rounded projections extending posteroventrally over cauda; petiole attached to dorsal shield by sclerotized bridge (see Figures 1i and j), bridge as seen laterally narrow with a rather deep, rounded curve ventrally (the narrow sclerotized bridge, resembling cartilage, suggested name *stenochondrus*); petiole with associated hyaline structure complex and tubular, two anterolateral parts of petiole thick at the base, projecting dorsomedially, becoming pointed at their ends, hyaline structure forms most of posterior tubular portion, inside of which along the posterior wall is another tubular structure which flares out dorsally (see Figure 1j), a pair of dorsally projecting setae occur at junction of bridge with petiole; acetabular plates extending far up the sides of body; palp (see Figure 1h) with several long setae, medial surface of palp segment two with a patch of numerous setae; third and fourth legs with numerous swimming hairs while those on the first and second legs fewer in number.

**HOLOTYPE:** Adult male, collected from swampy area beside Louisiana State Road 22, 6 miles northeast of Sorrento and U.S. 61, in Ascension Parish, Louisiana, August 17, 1963.

**PARATYPES:** Four males, same date and locality as holotype; one male, from Shelby Lake near Grassy Lake Road in Shelby Forest State Park, Shelby County, Tennessee, June 22, 1961; two males, from Reelfoot Lake by C. C. Hoff, Obion (perhaps also Lake) County, Tennessee, summer 1942.

**HABITAT:** Algae and other water vegetation in permanent lakes and swampy areas.

**RANGE:** Known from two lakes in west Tennessee and a swampy area in Ascension Parish, Louisiana.

**DISCUSSION:** This new species differs from other closely related species in the following set of characteristics: (1) dorsal shield much wider than long, appearance dorsally variable from rectangular to squarish in shape, (2) posteromedial area of caudal lobes bear dorsomedially projecting rounded humps which do not touch medially, (3) sclerotized bridge, attaching the petiole to ventral side of dorsal shield, narrow (as seen from lateral view) with a rather deep, rounded curve ventrally, and (4) two anterolateral parts of petiole thick at base, pro-

jecting dorsomedially becoming pointed at their ends, hyaline structure forms most of posterior tubular portion, inside of which along the posterior wall is another tubular structure which flares out dorsally.

#### ARRENURUS LYRIGER, MARSHALL

*Arrenurus lyriger* Marshall, 1908, Trans. Amer. Micros. Soc., 28:94-95, pl. 9, Fig. 26, pl. 10, figs. 27-28.

**DESCRIPTION:** Male: (See Figures 2a-e) Based on 6 specimens (Marshall (1908) indicated length 1.00 mm. and width 0.79 mm.). Length 0.96-1.11 mm.; width 0.76-0.87 mm.; length of cauda 0.21-0.24 mm.; width of cauda 0.56-0.67 mm.; length of dorsal shield 0.36-0.38 mm.; width of dorsal shield 0.41-0.46 mm. Body proper almost circular in outline, widest near mid-region; with a strong bulge over each eye, with each bulge having a small rounded projection anteriorly between which is a rounded concavity; dorsally projecting humps (best seen laterally) near mid-region; dorsal shield slightly wider than long, bearing two pairs of glandularia, one pair of long setae anteriorly and two pairs of short, thick setae; dorsal furrow complete and restricted to dorsal surface; cauda much wider than long, somewhat constricted at its base, with mostly rounded corners, median notch or cleft (best seen in ventral view) separates cauda into two lobes, posteromedial area of lobes bear dorsomedially projecting rounded humps which, in specimens observed, do not touch medially, one pair of dorsomedially projecting rounded humps on anterior portion of cauda, each lobe of cauda with three long and two short setae; dorso-posterior area of ventral shield with rounded area laterally and medially, with medial area having two rounded projections extending posteroventrally over cauda; petiole attached to dorsal shield by sclerotized bridge (see Figures 2d and e), bridge as seen laterally rather thick with only slight ventral curve, dorsally the petiole resembles a lyre in shape, surrounded by a complex bag-like hyaline structure usually somewhat pointed posteriorly, a pair of dorsally projecting setae occur at junction of bridge with petiole just anterior to which a pair of tear-shaped, hyaline structures are attached laterally to bridge; acetabular plates extending far up the side of the body; palp (see Figure 2c) with several long setae, medial surface of palp segment two with a patch of numerous setae; third and fourth legs with numerous swimming hairs while those on the first and second legs fewer in number.

**TYPE MATERIAL:** Field Museum of Natural History (Chicago).

**RANGE:** Michigan, Missouri, New Hampshire, and Wisconsin. This species was erroneously reported from Tennessee (Wilson, 1961, pp. 210-211) which turned out to be *A. muttkowskii*, hence, collection data on p. 211 refers to *A. muttkowskii*. It is probably that *A. lyriger* does occur in Tennessee as at has been collected in central Missouri.

**DISCUSSION:** This species differs from other closely related species in the following set of characteristics: (1) dorsal shield slightly wider than long, roughly 'heart-shaped' in dorsal view, (2) posteromedial area of caudal lobes bear dorsomedially projecting rounded humps which, in specimens observed, do not touch medially, (3) sclerotized bridge, attaching the petiole to ventral side of dorsal shield, rather thick (as seen from lateral view) with only slight ventral curve, and (4) dorsally the petiole resembles a lyre in shape, surrounded by a complex bag-like hyaline structure usually pointed posteriorly.

#### ARRENURUS MUTTKOWSKII, MARSHALL

*Arrenurus muttkowskii* Marshall, 1940, Trans. Wisconsin Acad. Sci., 32:144, pl. 4, Figs. 33-35

**DESCRIPTION: MALE:** (See Figures 2f-j) Based on 63 Tennessee specimens (measurements of 3 Marshall specimens from Wisconsin occur in parentheses; Marshall (1940) gave only one measurement: length of male 1.40 mm.). Length 0.90-1.05 mm. (1.08-1.12 mm.); width 0.62-0.76 mm. (0.77-0.79 mm.); length of cauda 0.21-0.28 mm. (0.26-0.27 mm.); width of cauda 0.46-0.56 mm. (0.55-0.57 mm.); length of dorsal shield 0.24-0.29 mm. (0.27-0.32 mm.); width of dorsal shield 0.34-0.39 mm. (0.38-0.39 mm.). Body proper almost circular in outline, widest near mid-region; with a bulge over each eye, with

each bulge having a small rounded projection anteriorly between which is a rounded concavity; dorsally projecting humps (best seen laterally) near mid-region; dorsal shield slightly wider than long, bearing two pairs of glandularia, one pair of long setae anteriorly and two pairs of short, thick setae; dorsal furrow complete and restricted to dorsal surface; cauda much wider than long, only slightly constricted at its base due to lateral rounded areas (best seen dorsally) near its junction with body, with mostly rounded corners, median notch or cleft (best seen in ventral view) separates cauda into two lobes, posteromedial area of lobes bear dorsomedially projecting rounded humps which touch medially, one pair of dorsomedially projecting rounded humps on anterior portion of cauda, each lobe of cauda with three long and two short setae; dorso-posterior area of ventral shield almost straight across body with rounded areas laterally and medially, with medial area having two rounded projections extending posteroventrally over cauda; petiole attached to dorsal shield by sclerotized bridge (see Figures 2i and j), bridge as seen laterally rather thick, moreso anteriorly, with a rather distinct ventral curve, dorsally the petiole appears tubular (in all 66 preserved specimens the petiole leans to the right as shown in Figures 2f and i; Marshall (1940) was probably referring to this when she indicated that the petiole does not preserve well), petiole surrounded by a hyaline structure, a pair of dorsally projecting setae occur at junction of bridge with petiole; acetabular plates extending far up the sides of the body; palp (see Figure 2h) with several long setae, medial surface of palp segment two with a patch of numerous setae; third and fourth legs with numerous swimming hairs while those on the first and second legs fewer in number.

**TYPE MATERIAL:** Field Museum of Natural History (Chicago).

**RANGE:** Iowa, Wisconsin, and in Tennessee from collections made in Percy Warner Lake, Davidson County, Piersall Lake in Shelby Forest State Park, Shelby County, and Reelfoot Lake by C. C. Hoff, Obion County.

**DISCUSSION:** This species differs from other closely related species in the following set of characteristics: (1) dorsal shield slightly wider than long, roughly 'heart-shaped' in dorsal view, (2) posteromedial area of caudal lobes bear dorsomedially projecting rounded humps which touch medially, (3) sclerotized bridge, attaching the petiole to ventral side of dorsal shield, rather thick (as seen from lateral view), moreso anteriorly, with a rather distinct ventral curve, and (4) petiole appears tubular and is surrounded by a hyaline structure. In all 66 preserved specimens (63 from Tennessee and 3 from Wisconsin) the petiole leans to the right. Recent unsuccessful attempts at collecting additional specimens leaves the question unanswered as to whether this condition is the result of preservation or if the condition is present in living specimens.

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