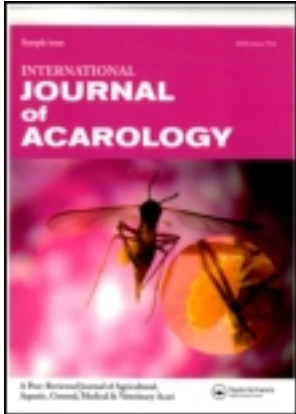


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A taxonomic study of the genus *Haemogamasus* in North America, with descriptions of two new species (Acari: Mesostigmata, Laelaptidae)

G. L. Williams^a, R. L. Smiley^b & B. C. Redington^c

^a 12400 Shelter Lane, Bowie, Maryland, U.S.A., 20715

^b Systematic Entomology Laboratory, IIBIII, Agricultural Research Service, USDA, Beltsville, Maryland, 20705

^c Department of Parasitic Diseases, Walter Reed Army Institute of Research, Washington, D. C., 20012

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**A TAXONOMIC STUDY OF THE GENUS *HAEMOGAMASUS* IN NORTH AMERICA,
WITH DESCRIPTIONS OF TWO NEW SPECIES
(ACARI: MESOSTIGMATA, LAELAPTIDAE) ¹**

G. L. Williams², R. L. Smiley³, B. C. Redington⁴

----- ABSTRACT — A key, descriptions, illustrations, distribution, and hosts are given for eleven species of *Haemogamasus* known to occur in North America. Included are descriptions of two new species. Species are placed into two groups, the *liponyssoides* and *reidi* groups, based on morphological characteristics. -----

INTRODUCTION

Mites of the genus *Haemogamasus* Berlese are common in the nests and on the bodies of small mammals and, rarely, on birds. They occur over much of the world, although none are known from South America. Some species are strictly nest dwellers feeding on small organisms and organic debris, some are facultative parasites, taking occasional blood meals and others are obligate parasites feeding exclusively on the blood of their host.

North American species of *Haemogamasus* have long been in need of revision. Published keys and descriptions are insufficient for proper determination of specimens. The purpose of this paper is to facilitate identification of members of this genus in North America.

Haemogamasus was proposed by Berlese in 1889 for his new European species *H. hirsutus*. The first North American species, *H. longitarsus* (Banks) was described in 1910. Ewing (1925, 1933) described several North American species and proposed *Euhaemogamasus*, type-species *E. onychomydis*, for those *Haemogamasus* species lacking accessory setae on the sternal shield. Vitzthum (1930) published a world-wide revision of the genus. In 1951, Keegan revised the subfamily Haemogamasinae and treated several species as junior synonyms of *E. ambulans* (Thorell), including *H. nidi* Michael, *H. reidi* Ewing, and *H. (E.) onychomydis* (Ewing).

Asanuma (1951) considered *Euhaemogamasus* a junior synonym of *Haemogamasus* and described a new species from Manchuria which varied in the number of sternal accessory setae from zero to six. Jameson (1952) described *Euhaemogamasus keegani*, noted its similarity to *Haemogamasus harperi* Keegan (1951) and expressed doubts that these genera represented a natural division. Bregetova (1953) also treated *Euhaemogamasus* as a junior synonym of *Haemogamasus* and agreed, for the most part, with Keegan's synonymy of *H. (E.) ambulans*. Strandtmann and Wharton (1958) used Keegan's 1951 review extensively in their treatment of *Haemogamasus*, and later workers generally adopted their classification. Evans and Till (1966) revised British species and introduced new synonymy. Redington (1970) clarified many of the relationships among species after comparing descriptions of *H. reidi* and other American *Haemogamasus*.

Approximately 350 slides with 420 specimens were examined for this work. This material is in the following collections: (unless otherwise noted material is from the U. S. N. M. collection,

1. Adapted from part of a thesis submitted by the senior author to the faculty of the Graduate School of the University of Maryland in partial fulfillment of the requirements for the degree of Master of Science.
2. 12400 Shelter Lane, Bowie, Maryland, U. S. A. 20715.
3. Systematic Entomology Laboratory, IIBIII, Agricultural Research Service, USDA, Beltsville, Maryland 20705.
4. Department of Parasitic Diseases, Walter Reed Army Institute of Research, Washington, D. C. 20012.

British Museum (Natural History), London (BM); University of California, Berkeley (UCB); Museum of Comparative Zoology, Cambridge (MCZ); Ohio State University, Columbus (OSU), Texas Technical University, Lubbock (TTU); personal collection of G. L. Williams (GW); U. S. National Museum of Natural History, Washington, D. C. (USNM).

In addition to species dealt with in this paper, type and nontype material of the following species was also examined: *H. arvicolarum* (Berlese) (BM); *H. citelli* Bregetova and Nelzina (BM); *H. hermonensis* (BM); *H. hirsutosimilis* Willman (BM); *H. hirsutus* Berlese (BM, USNM); *H. horridus* Michael (BM); *H. japonicus* Asanuma (BM); *H. liberiensis* Hirst (BM); *H. michaeli* Oudemans (BM); *H. nidi* Michael (BM, USNM); *H. nidiformes* Bregetova (BM); *H. serdjukovae* Bregetova (BM); and *H. suncus* Allred (USNM).

Measurements were made with a Wild M20 phase contrast microscope at 100x and 400x. Descriptions are given after the manner of Redington (1970). Measurements and counts for each species are given as follows, unless otherwise indicated: Holotype followed by (minimum-maximum) and in the case of males, the mean followed by (minimum-maximum). Measurements are expressed in microns (μ). For general terminology see Evans and Till (1965). Tarsal length/width is rounded to the nearest one-tenth. Drawings were made in the style of Redington (1970) and illustrations are of types whenever possible; otherwise typical specimens and structures were chosen. Measurements of structures illustrated are in the text.

Genus *Haemogamasus* Berlese, 1889

Liponissus Kolenati 1858 after Evans and Till (1966).

Haemogamasus Berlese 1889. Type species, *Haemogamasus hirsutus* Berlese, by original designation.

Euhaemogamasus Ewing 1933. Type-species, *Euhaemogamasus onychomydis* Ewing, by original designation.

Groschaftella Privora and Samsinak 1957. Type-species, *Eulaelaps pontiger* Berlese, by original designation.

DIAGNOSIS — Medium to large mites from 792 to 1300 μ in length. Densely covered with setae. Chelicerae toothed on inner surface or edentate. Spermadactyl inconspicuous to large and highly modified. Tectum elongate, tongue-like, with a fimbriate margin.

Dorsal shield entire in both sexes, large, oval or narrowing posteriorly, covered with setae. Female sternal shield large, straight to strongly concave posteriorly, three pairs of primary sternal setae and zero to many accessory setae. Three pairs of lyriform pores associated with sternal shield, third pair sometimes off shield. Genitoventral shield narrow to very broad, flask shaped, one pair of primary genital setae and 11 to over 60 accessory setae. Anal shield inverted pyriform, three primary anal setae and zero to seven accessory setae. Metapodal shields small, irregularly shaped, often inconspicuous. Male with single holovenral shield with or without small separate metapodals. Leg IV of adult and deutonymph with two postero-lateral setae on genu. Leg II of male with or without spinose ventral setae, otherwise not unusually ornamented.

DISCUSSION — North American species are readily separated into two major species groups. Radovsky (1960) characterized species in the *H. liponyssoides* group as having untoothed slender chelicerae, slightly modified male spermadactyl, most body and all leg setae unbarbed, female anal shield elongate pyriform, normally with seven accessory setae. The second group, herein called the *H. reidi* group, is characterized by stout toothed chelicerae, well developed spermadactyl, many body and many leg setae barbed, female anal shield broadly pyriform, with zero to six accessory setae. Radovsky (1969) presented an excellent account of the cheliceral adaptations for haematophagous feeding. He stated that the most frequent modification involves the chelae becoming slender, more or less pointed, without conspicuous teeth and arthrodial processes. These modifications are characteristic for the *liponyssoides* group included in this study.

KEY TO ADULT *HAEMOGAMASUS* OF NORTH AMERICA

1. Females 2
 - Males (that of *H. onychomydis* (Ewing) is unknown) 13
2. Chelicerae slender edentate; third pair of sternal lyriform pores dimple-like and posterior to shield; anal shield elongate, pyriform with seven (rarely six or eight) accessory setae; setae on gnathosoma, anal shield, and legs unbarbed (*liponyssoides* group) 3
 - Chelicerae stout and strongly toothed; third pair of sternal lyriform pores not dimple-like, on posterior margin of shield; anal shield broad, pyriform with zero to six accessory setae; some setae on gnathosoma, anal shield, and legs barbed (*reidi* group) 8
3. Sternal shield with caudolateral invaginations outside sternal setae III; peritreme short (about 100 μ); tarsi abruptly narrowed distally 4
 - Sternal shield without caudolateral invaginations outside sternal setae III; peritreme much longer (about 200 μ long); tarsi not abruptly narrowed distally 5
4. Sternal shield with few accessory setae; second cheliceral segment about 11 times longer than wide *harperi* Keegan
 - Sternal shield without accessory setae; second cheliceral segment about 7 times longer than wide *keegani* (Jameson)
5. Tectum with long distal and long lateral fimbriae; deutosternal groove narrow with one to eight teeth in anterior rows 6
 - Tectum with long distal and short lateral fimbriae; deutosternal groove broad with eight or more teeth in anterior rows 7
6. Sternal shield with posterior margin invaginated to level about midway between sternal setae II and III *liponyssoides liponyssoides* Ewing
 - Sternal shield with posterior margin invaginated to level of sternal setae III *liponyssoides hesperus* Radovsky
7. Sternal shield with posterior margin nearly straight; genitoventral shield with 30 or more accessory setae; *pilus dentilis* and dorsal seta present *occidentalis* Keegan
 - Sternal shield with posterior margin invaginated nearly to level of sternal setae III; genitoventral shield with 20 or less accessory setae; *pilus dentilis* and dorsal seta absent *ghanii* Williams, n. sp.
8. Sternal shield with accessory setae; hypostomal setae I unbarbed; *pilus dentilis* setiform *ambulans* (Thorell)
 - Sternal shield without accessory setae; hypostomal setae I barbed or unbarbed; *pilus dentilis* variable 9
9. Sternal shield with posterior margin invaginated to between sternal setae I and II; hypostomal setae I unbarbed; setation of dorsal and genitoventral shields sparse; legs II-IV with relatively stout ventral setae *pontiger* (Berlese)
 - Sternal shield with posterior margin never invaginated to or above sternal setae II; hypostomal setae I barbed; setation of dorsal and genitoventral shields dense; legs without stout ventral setae 10
10. Genitoventral shield very broad, flask-shaped, width about one-half length 11
 - Genitoventral shield shape variable, never extremely broad, width usually about one-third length 12

11. Genitoventral shield with accessory setae extending anteriorly to flap of shield; *pilus dentilis* very long, expanded laterally *longitarsus* (Banks)
 - Genitoventral shield with accessory setae only on posterior two-thirds of shield, none past genital setae; *pilus dentilis* long and basally swollen *thomomysi* Williams, n. sp.
12. *Pilus dentilis* short, setiform; large corniculi (about 65 μ long); chelicerae with a conspicuous brush border at base; leg setae thickly barbed; most dorsal setae barbed
 *anychomydis* (Ewing)
 - *Pilus dentilis* long, curved distally; smaller corniculi (about 30 μ long); no brush border at base of chelicerae; leg setae sparsely barbed; only posterior and marginal dorsal setae barbed *reidi* Ewing
13. Chelicerae relatively slender, edentate, with spermadactyl only slightly modified; leg setae unbarbed; holovenral shield with accessory setae extending anteriorly only to level between sternal setae IV and genital setae (*liponyssoides* group) 14
 - Chelicerae stout with strong teeth and spermadactyl moderately to highly modified; many leg setae barbed; holovenral shield with accessory setae variable (*reidi* group) 18
14. Tarsus II with evenly tapered, stout ventral setae; only a few scattered denticles anteriorly bordering deutosternal groove 15
 - Tarsus II with unilaterally basally swollen, stout ventral setae; deutosternal groove variable 16
15. Comparatively heavy body sclerotization; spermadactyl heavily sclerotized and strongly curved *ghanii* Williams, n. sp.
 - Relatively light body sclerotization; spermadactyl lightly sclerotized and slightly curved *occidentalis* (Keegan)
16. Holovenral shield not extending anterolateral to coxa IV; no denticles or depressions bordering deutosternal groove; peritreme short (about 90 μ) 17
 - Holovenral shield extending anterolateral to coxa IV to midcoxa; toothed depressions bordering deutosternal groove; peritreme much longer (about 200 μ)
 *H. liponyssoides* Ewing and *H. hesperus* Radovsky*
17. Holovenral shield with irregular posterior margin, laterally extending only to mid-coxa IV, not expanded anteriorly toward coxa *harperi* Keegan
 - Holovenral shield with regular posterior margin, laterally extending past outside edge of coxa IV, strongly expanded anteriorly toward coxa *keegani* (Jameson)
18. Holovenral shield with accessory setae extending anteriorly to level of sternal setae I; *pilus dentilis* setiform; spermadactyl short, bent 45 degrees over movable digit; digit with bifid tip; leg II not much thickened, without stout ventral setae *ambulans* (Thorell)
 - Holovenral shield without accessory setae anterior to sternal setae II; *pilus dentilis* variable; spermadactyl size and shape variable; movable digit bifid, simple or spurred; leg II shape and ornamentation variable 19
19. Spermadactyl about one-quarter length of movable digit, bent 90 degrees over movable digit; holovenral shield with accessory setae extending anteriorly to level of genital setae, rarely to sternal setae IV 20
 - Spermadactyl nearly twice as long as movable digit, extending anteriorly almost perpendicular to long axis; holovenral shield with accessory setae extending anteriorly to level between sternal setae III-IV or to sternal setae III 21
20. Holovenral shield with sparse accessory setae; *pilus dentilis* short, setiform; leg II not thickened, without stout ventral setae *pontiger* (Berlese)

* There are no reliable characters to separate *H. l. liponyssoides* Ewing and *H. l. hesperus* Radovsky males.

- Holoventral shield densely covered with stout accessory setae; *pilus dentilis* long, digitiform; leg II thickened, with stout ventral setae *reidi* Ewing
- 2l. Spermadactyl massive, curved, with tip folded; *pilus dentilis* long and expanded
..... *longitarsus* (Banks)
- Spermadactyl large, distally digitiform, almost straight; *pilus dentilis* setiform
..... *thomomysi* Williams, n. sp.

LIPONYSSOIDES GROUP

Both sexes with gnathosomal and leg setae unbarbed; primary ventral setae and paired apical setae unbarbed. Females: Chelicerae long, slender and edentate; third pair of sternal lyriform pores posterior to shield; anal shield elongate pyriform with 6-8, typically 7, accessory setae arranged in characteristic pattern (figs. 1-6f). Males: Chelicerae edentate, slender, slightly modified for sperm transfer and feeding.

Haemogamasus liponyssoides Ewing (Figs. 1 a-n, 2 a-n)

Haemogamasus liponyssoides Ewing 1925: 139, Vitzthum, 1930: 402.
Euhaemogamasus liponyssoides (Ewing): Keegan 1951: 244.

DIAGNOSIS — A large species characterized by long lateral and distal fimbriae on the tectum and a narrowed deutosternal groove with one to eight teeth in the anterior rows; male with weakly developed spermadactyl and with toothed depressions bordering deutosternum.

Haemogamasus liponyssoides liponyssoides Ewing (Fig. 1 a-n)

DIAGNOSIS — *Haemogamasus liponyssoides liponyssoides* is characterized by the posterior margin of the sternal shield being invaginated to midway between sternal setae II and III.

FEMALE—Described from lectotype, one paralectotype, and six additional females: Lectotype measurements are followed by minimum and maximum in parentheses.

Cheliceral segment I 131 (116-137) μ long, segment II 306 (262-326) μ long. Movable digit (fig. 1a) 87 (84-102) μ long, slender, curved laterally. Fixed digit slender, curved. *Pilus dentilis* minute, setiform at base of distal curvature. Dorsal seta setiform. Dorsal and lateral lyriform fissures indistinct. Capitular setae 84 (70-87) μ apart, hypostomal setae II 65 (47-67) μ apart. Deutosternal groove (fig. 1 b) parallel sided with 11 (10-12) rows of denticles, 4-9 per row. Corniculi 58 (50-58) μ long. Tectum (fig. 1 c) slender, triangular, long slender branched fimbriae on tip and sides for about distal one-quarter. Pedipalp with two-tined apotele; second ventral trochanteral seta v_2 broad, unbarbed; genu with first anterolateral seta al_1 thickened.

Dorsal shield 960 (960-1104) μ long by 600 (491-648) μ wide, covered with setae mostly of uniform length, few anterior and marginal setae barbed. Small pores scattered over shield surface. Tritosternum base 47 (47-58) μ long, laciniae 175 (161-207) μ long. Presternal area with small teeth on reticulations. Sternal shield (fig. 1 d) 149 (146-151) μ long by 175 (175-190) μ wide anteriorly and 239 (233-259) μ wide posteriorly, without accessory setae. Sternal setae I 87 (70-87) μ apart, sternal setae I and III 121 (108-125) μ apart. Posterior concavity extending anteriorly to level between sternal setae II and III, 52 (52-58) μ deep by 146 (146-178) μ wide. Genitoventral shield (fig. 1 e) narrow, flask-shaped, 428 (413-481) μ long, including anterior flap, by 146 (137-161) μ wide at base, 25 (24-30) accessory setae on posterior one-third of shield. Anal shield (fig. 1 f) 184 (184-212) μ long by 102 (102-122) μ wide with 7 (rarely 6) accessory setae. Paranal setae 67 (67-99) μ long, postanal seta 108 (102-111) μ long. Small narrow

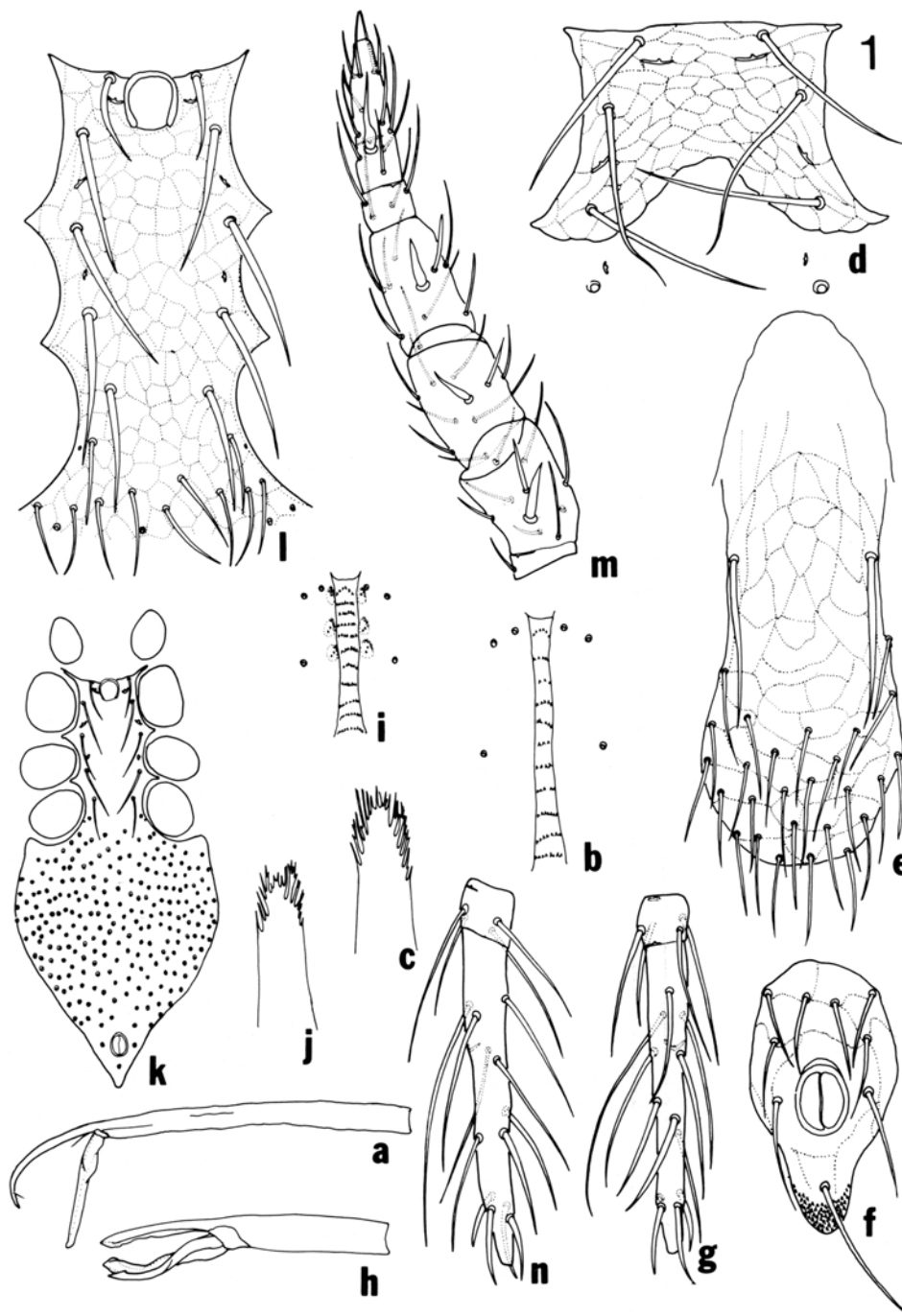


Fig. 1: *Haemogamasus liponyssoides liponyssoides* Ewing, a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genitoventral shield; f, anal shield; g, tarsus IV-ventral view; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-ventral view; n, tarsus IV-ventral view.

metapodal shields posterior to coxae IV. Stigma at anterior edge of coxa IV, peritreme extending anteriorly to posterior edge of coxa II, 166 (148-181) μ long. Anterior end of peritrematal shield appears to end freely, posterior end narrowly attached to podal shields of coxae IV.

Tarsus IV with second posterodorsal seta pd_2 long (fig. 1 g). Tarsal length/width as follows: Leg I 5. 6, Leg II 4. 3, Leg III 5. 2, and Leg IV 7. 9.

MALE — The following based on four specimens, including one paralectotype, similar to females except as follows:

Cheliceral segment I 87 (84-90) μ long, segment II 199 (195-204) μ long. Movable digit (fig. 1 h) 93 (90-96) μ long, edentate, slender with poorly developed spermadactyl. Capitular setae 64 (61-70) μ apart, hypostomal setae II 58 (55-64) μ apart. Deutosternal groove (fig. 1 i) nearly parallel sided, with 11 (10-12) transverse rows of denticles, 5-12 per row, groove bordered anteriorly by three pairs of depressions, each containing 1-8 denticles. Corniculi blunt, 52 (48-59) μ long.

Dorsal shield 841 (792-888) μ long by 527 (456-540) μ wide. Tritosternum base 58 (41-64) μ long, laciniae 104 (113-128) μ long. Holoventral shield (fig. 1 k, l) 741 (727-750) μ long by 115 (102-128) μ wide at level of genital opening and 348 (340-355) μ wide below level of coxae IV, extending laterally and anteriorly around coxa to mid-coxa. Shield with four pairs of sternal setae, genital setae distinct. Sternal setae I 78 (73-84) μ apart, sternal setae I and III 102 (93-116) μ apart. Paranal setae 52 (41-58) μ long. Postanal seta 58 (47-70) μ long. Numerous setae on opisthogastric region of holoventral shield extending anteriorly to level of coxae IV, below genital setae. Peritreme 120 (116-131) μ long, extending anteriorly to level of coxa II. Anterior tip of peritrematal shield appears free from dorsal shield, posterior edge not fused to holoventral shield.

Thickened leg II (fig. 1 m) bears regularly swollen, stout ventral setae as follows: One on femur v_3 , one on genu av , one on tibia av , stout seta av_2 on tarsus basally swollen on one side. Tarsus IV with seta pd_2 long (fig. 1 n). Tarsal length/width as follows: leg I 4. 3, leg II 4. 2, leg III 5. 1, and leg IV 7. 9.

TYPES — As Ewing did not designate a holotype, we have selected a slide containing 2 female syntypes and here designate the left hand specimen, which is ringed in ink, "lectotype". This slide is marked: Right label "from mole *S. argentatus*, Ames, Iowa, July 1916, by J. E. Guthrie", left label "Lectotype (ringed) and paralectotype designated by G. L. Williams, USNM Type No. 948". (USNM). Paralectotypes seen: 1 female on slide with lectotype and 1 male on separate slide—same data. (USNM).

DISTRIBUTION — Southern Canada and most of eastern United States.

ADDITIONAL SPECIMENS EXAMINED — ALABAMA: Dale Co., on cotton mouse, V-18-1937, (2 deutonymphs). ILLINOIS: Champaign Co., Urbana, in *Microtus ochrogaster* nest 3264, IV-9-1939, (3 females on same slide). MARYLAND: Montgomery Co., shore near Plummers Island, in nest of small mammal, IV-27-1924, (1 female); Prince George's Co., College Park, in mouse nest, IX-1973, (3 females on separate slides). MASSACHUSETTS: Dukes Co. Vineyard Haven, on short-tailed shrew, IV-20-1938, (2 females, 1 male on same slide); Gay Head, in nest of *Peromyscus* or *Microtus*, II-14-1939, (female on slide with two female *H. ambulans* TTU); Worcester Co., Mt. Watatic, Ashburnham, on *Sorex fumeus*, X-12-1937; NEW YORK: Tompkins Co., Ithaca, on *Microtus p. pennsylvanicus*, X-4-1936, (1 female). PENNSYLVANIA: Pike Co., on *Blarina brevicauda* No. 947, X-7-1945, (1 nymph). TENNESSEE: Anderson, Co., Oak Ridge, on *Peromyscus leucopus* XII-29-1964, (1 female). VIRGINIA: Arlington Co., Arlington, on *Blarina brevicauda talpoides*, VII-17-1938, (1 female, 1 nymph—same slide). WASHINGTON, D. C.: On *Rattus norvegicus*, II-28-1946, (1 female). CANADA: Ontario, Welland Co., Point Abino, on *Pondscalops breweri*, IX-16-1945, (1 male). MEXICO:

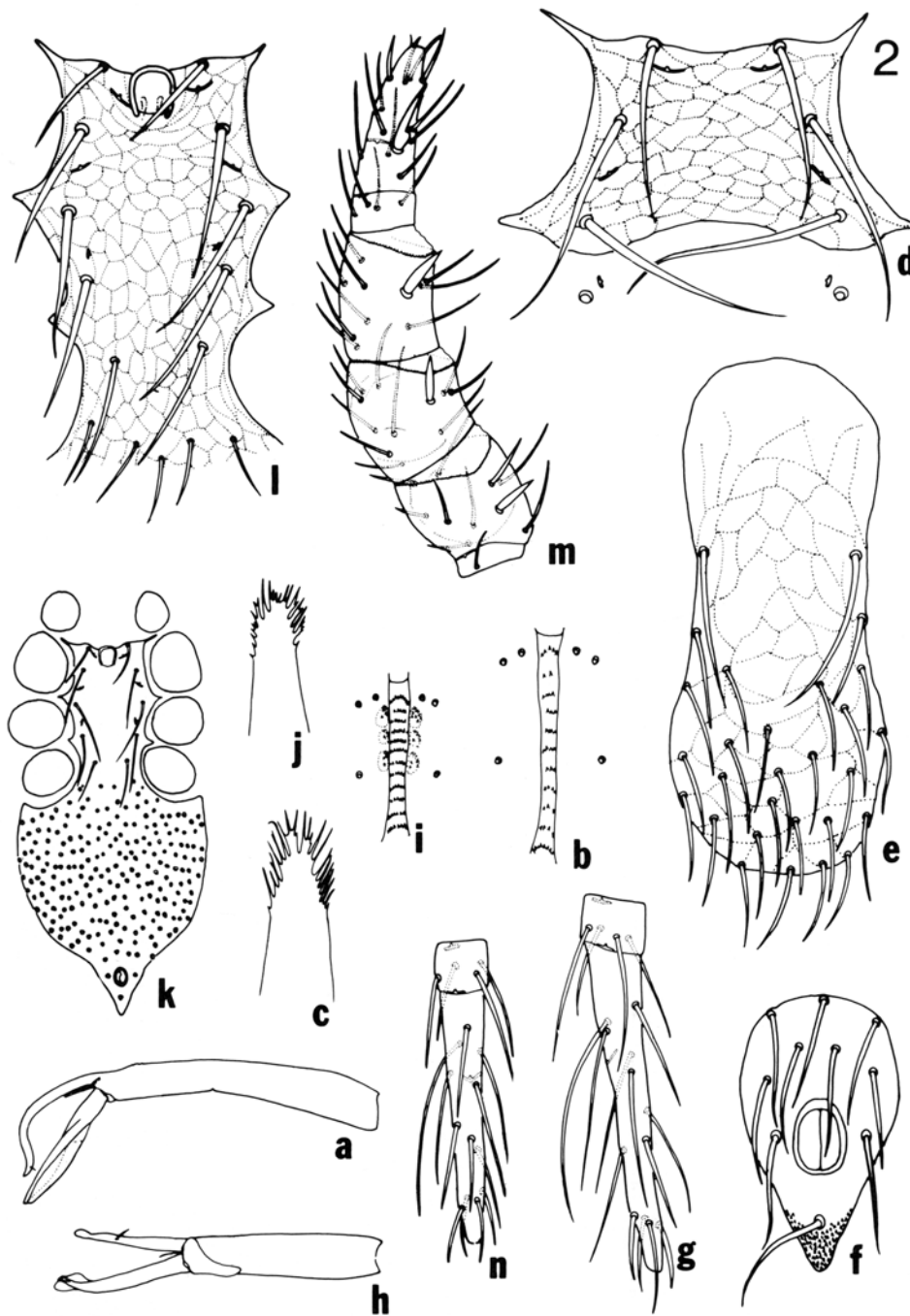


Fig. 2: *Haemogamasus lipomyssoides hesperus* Radovsky, a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield, e, genitoventral shield; f, anal shield; g, tarsus IV-lateral view, dorsal surface on left; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-ventral view; n, tarsus IV-ventral view. (h-from Radovsky, 1960).

Tamaulipas, Rancho Del Cielo, in *Neotoma* nest, VII-4-1965, (1 female); same (1 female, 1 male on separate slides TTU).

Haemogamasus liponyssoides hesperus Radovsky
(Figs. 2 a-n)

Haemogamasus liponyssoides hesperus Radovsky 1960: 402.

DIAGNOSIS — A large sub-species of *H. liponyssoides* Ewing characterized by the female sternal shield with posterior margin invaginated to the level of sternal setae III.

FEMALE — Described from the holotype, five paratypes and one additional specimen.

Cheliceral segment I 131 (122-137) μ long, segment II 335 (277-337) μ long. Movable digit (fig. 2 a) 99 (87-99) μ long, slender and grooved. Fixed digit slender, curved and slightly shorter than movable digit. *Pilus dentilis* minute, setiform, at base of distal curvature. Dorsal and lateral lyriform fissures indistinct. Capitular setae 73 (67-79) μ apart, hypostomal setae II 64 (55-67) μ apart. Deutosternal groove (fig. 2 b) parallel sided with 11 (10-13) rows of denticles, 1-13 per row. Corniculi 41 (41-55) μ long. Tectum (fig. 2 c) slender, triangular with long slender branched or unbranched fimbriae anteriorly and laterally for about distal one-quarter. Pedipalp with two-tined apotele; trochanteral seta v_2 broad; genu with seta al_1 thickened.

Dorsal shield 1102 (924-1102) μ long by 612 (564-696) μ wide covered with setae, mostly of uniform length, few anterior and some scattered lateral setae barbed.

Tritosternum base 79 (58-79) μ long, laciniae 175 (166-195) μ long. Presternal area sclerotized with strong teeth on reticulations. Sternal shield (fig. 2 d) 160 (146-160) μ long by 175 (166-195) μ wide anteriorly and 248 (219-259) μ wide posteriorly without accessory setae. Sternal setae I 87 (70-87) μ apart, sternal setae I and III 131 (114-131) μ apart. Posteriorly concavity extending anteriorly to level of sternal setae III, 21 (15-30) μ long by 163 (151-169) μ wide. Genitoventral shield (fig. 2 e) narrow, flask shaped, 326 (326-337) μ long, including anterior flap, by 169 (147-169) μ wide at base, 25 (22-32) accessory setae on posterior two-thirds of shield. Anal shield (fig. 2 f) 190 (172-190) μ long by 111 (105-119) μ wide with 7 accessory setae. Paranal setae 76 (76-87) μ long, postanal seta 95 (93-99) μ long. Small elongate metapodal shield posterior to coxa II. Stigma at anterior edge of coxa IV, peritreme extending anteriorly to level of coxa II, 225 (168-245) μ long. Both anterior and posterior tip of peritrematal shield appear free.

Tarsus IV with pd_2 long (fig. 2 g). Tarsal length/width as follows: Leg I 4.4, Leg II 3.5, Leg III 4.9, and Leg IV 7.

MALE — The following description is based on two paratypes. Measurements are expressed from minimum to maximum. Males similar to females except as follows:

Cheliceral segment I 90 - 99 μ long, segment II 196 - 204 μ long. Movable digit with spermadactyl (fig. 2 h) 96-102 μ long, edentate, slender and curved with tip surrounded by a membranous bursa. Capitular setae 55-58 μ apart, hypostomal setae II 52-55 μ apart. Deutosternal groove (fig. 2 i) narrowed medially with 11-12 transverse rows of denticles, 4-14 per row. In addition, groove bordered anteriorly by three pairs of depressions, each containing 1-8 denticles. Corniculi blunt, 47-49 μ long.

Dorsal shield 900-912 μ long by 420-502 μ wide. Tritosternum base 38-41 μ long, laciniae 122-128 μ long. Holovenral shield (figs. 2 k, l) 678-690 μ long by 125-134 μ wide at the level of genital opening and 335-349 μ wide below level of coxa IV, extending laterally and anteriorly around coxa to mid-coxa. Shield with four pairs of sternal setae, genital setae distinct. Sternal setae I 64-67 μ apart, sternal setae I and III 99-102 μ apart. Paranal setae 47-58 μ long, postanal

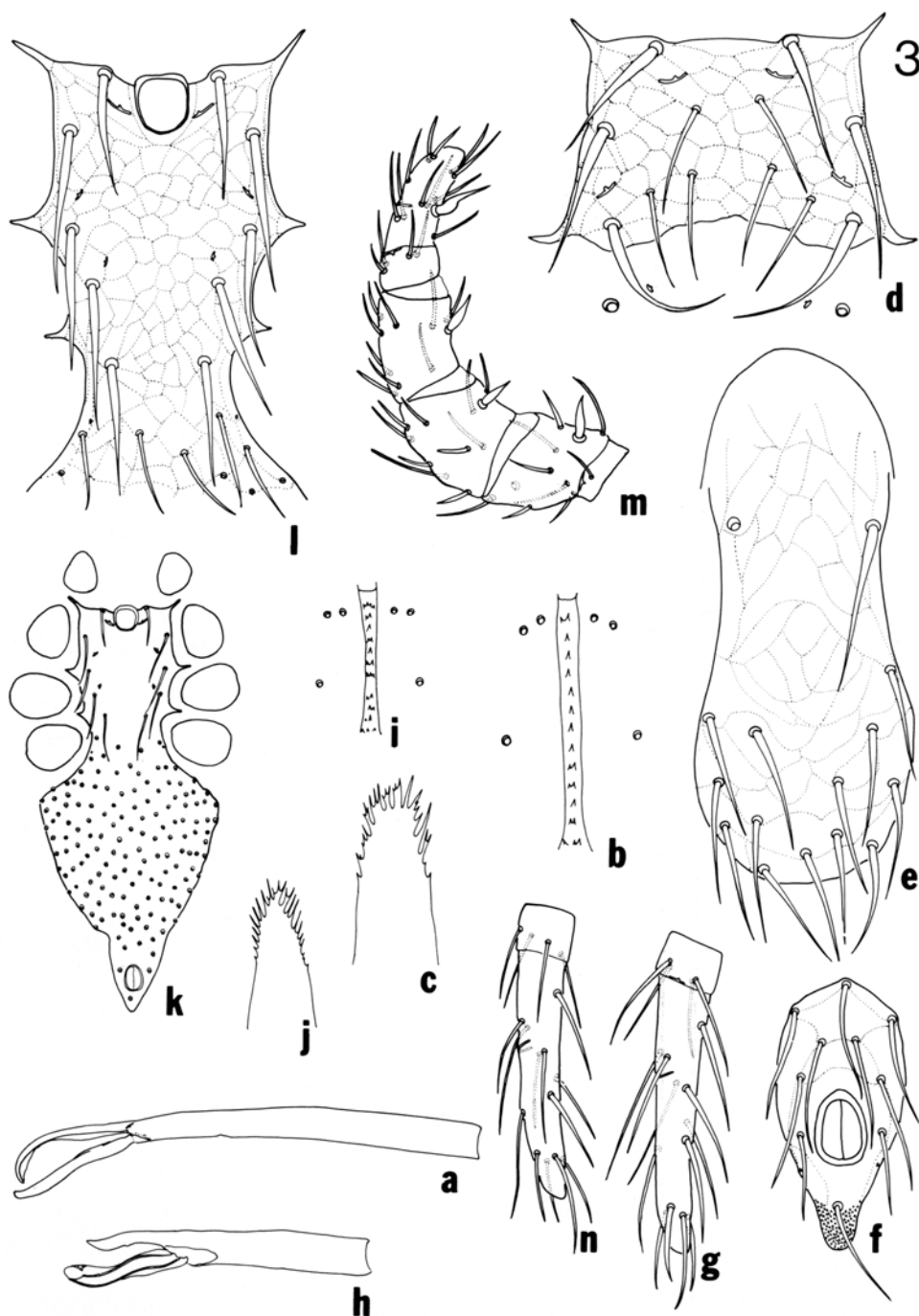


Fig. 3: *Haemogamasus harperi* Keegan. a-g, female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genito-ventral shield; f, anal shield; g, tarsus IV lateral view, dorsal surface on left; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-lateral view, dorsal surface on left; n, tarsus IV-lateral view, dorsal surface on left.

seta 74-81 μ long. Numerous setae on opisthogastric region extending anteriorly to the level of coxa IV, below genital setae. Peritreme 171-201 μ long, extends anteriorly to the level of coxae II. Anterior tip of peritrematal shield appears free from dorsal shield, posterior edge not fused to holovenral shield.

Thickened leg II (fig. 2 m) bears regularly swollen stout ventral setae as follows: One on femur v_3 , one on genu av , one on tibia av , stout seta av_2 on tarsus basally swollen on one side. Tarsus IV with pd_2 conspicuous and long (fig. 2 n). Tarsal length/width as follows: Leg I 3. 8, Leg II 3, Leg III 3. 9, and Leg IV 6. 3.

TYPES —The holotype female is on a slide marked "ex. nest of *Microtus californicus*, Calif. Strawberry Canyon, Berkeley, 26 Mar. 1958. F. J. Radovsky". (USNM). Paratypes seen: CALIFORNIA: Alameda Co., Strawberry Canyon, Berkeley, in nest of *Microtus californicus* 31 Dec. 1957, (1 female); same data, 31 July 1958, (F_1) lab culture from May 1958 stock (3 females-same slide); San Mateo Co., San Andreas Lake, 2 mi. west of Milbrae, in nest of *Microtus californicus*, 26 Nov. 1957, (1 female, 2 males on separate slides). (USNM).

DISTRIBUTION —This sub-species is known from California.

ADDITIONAL SPECIMENS EXAMINED — CALIFORNIA: Alameda Co., Calaveras Dam, on *Microtus californicus*, III-22-1945 (1 nymph UCB); in nest of *Microtus californicus*, VIII-7-1957 (2 females-same slide UCB); Contra Costa Co., Berkeley Hills, west of Jewel Lake, on *Scapanus latimanus*, II-28-1954 (1 male, 1 nymph-same slide UCB); Marin Co., nest of *Microtus californicus*, VIII-25-1948 (1 female UCB); San Mateo Co., San Andreas Lake, 2 mi. w. of Milbrae, in nest of *Microtus californicus*, XII-12-1957 (1 female); San Bruno, in nest of *Microtus californicus*, VI-27-1957 (2 males-same slide UCB); Skyline Blvd., in nest of *Microtus californicus*, VIII-5-1948 (1 nymph UCB).

Haemogamasus harperi Keegan
(Figs. 3 a-n)

Haemogamasus harperi Keegan 1951: 223; Jameson 1952: 603.

DIAGNOSIS — A medium sized species of the *lipomyssoides* group, distinguished by the presence of a small number of accessory setae on the sternal shield, and the male holovenral shield only slightly and irregularly expanded below coxae IV.

FEMALE — Described from the holotype, three paratypes, and five other specimens.

Cheliceral segment I 116 (105-131) μ long, segment II 478 (413-481) μ long. Movable digit (fig. 3 a) 138 (87-138) μ long, slender, untoothed. Fixed digit slender, untoothed. *Pilus dentilis* and dorsal seta absent. Dorsal and lateral lyriform fissures distinct. Capitular setae 87 (79-96) μ apart, hypostomal setae II 58 (55-64) μ apart. Deutosternal groove (fig. 3 b) parallel sided with 13 (12-14) transverse rows of denticles, 1-5 per row. Corniculi 58 (51-60) μ long. Tectum (fig. 3 c) narrow, triangular, deeply denticulate with long simple or forked anterior fimbriae and some short lateral projections. Pedipalp with two tined apotele; trochanteral seta v_2 broad; genu with seta al_7 thickened.

Dorsal shield 960 (912-1020) μ long by 564 (540-600) μ wide, thinly covered with setae. Tritosternum base 67 (45-67) μ long, laciniae 233 (209-258) μ long. Presternal area lacking small teeth on reticulations. Sternal shield (fig. 3 d) 157 (151-166) μ long by 193 (193-225) μ wide anteriorly and 233 (233-257) μ wide posteriorly, with stout sternal setae and 6 (4-7) smaller accessory setae. Sternal setae I 87 (84-102) μ apart, sternal setae I and III 131 (119-131) μ apart. Posterior concavity extending anteriorly nearly to or to level of sternal setae III. 18 (18-26) μ long by 131 (131-154) μ wide. Genitoventral shield (fig. 3 e) narrow flask shaped with slightly swollen base, 378 (349-396) μ long, including anterior flap, by 131 (131-154) μ wide at base. In

some specimens shield is flanked by small shield-like sclerotizations. Shield with 14 (11-18) accessory setae on posterior one-half of shield. Anal shield (fig. 3 f) 195 (194-204) μ long by 96 (93-103) μ wide with 7 (rarely 6-8) accessory setae. Paranal setae 55 (48-61) μ long, postanal seta 84 (70-84) μ long. Stigma at anterior edge of coxa IV with short peritreme extending anteriorly to level of coxa III, 116 (99-125) μ long. Anterior tip of peritrematal shield appears free from dorsal shield, posterior portion free or fused to podal shields of coxa IV.

Tarsi abruptly narrowed distally. Tarsus IV (fig. 3 g) with pd_2 only slightly longer than other setae. Tarsal length/width as follows: Leg I 3.3, Leg II 2.8, Leg III 4.1, and Leg IV 6.3.

MALE — The following is based on four specimens, similar to females except as follows:

Cheliceral segment I 70 (61-76) μ long, segment II 207 (201-216) μ long. Movable digit (fig. 3 h). 84 (82-88) μ long, hyaline. Movable digit with spermadactyl together 88 (85-93) μ long, spermadactyl slender, unmodified. Fixed digit shorter or equal in length to movable digit. *Pilus dentilis* and dorsal seta indistinct. Dorsal and lateral lyriform fissures indistinct. Capitular setae stout, 25 (22-26) μ apart, hypostomal setae II 29 (23-41) μ apart. Deutosternal groove narrow medially (fig. 3 i) with 11-12 rows of denticles, 1-4 per row. Corniculi blunt, 29 (23-34) μ long.

Dorsal shield 906 (828-960) μ long by 482 (408-576) μ wide. Tritosternum base 30 (29-32) μ long, laciniae 145 (142-151) μ long. Holoventral shield (figs. 3 k, l) 722 (655-762) μ long by 160 (157-166) μ wide at level of genital opening and 316 (277-329) μ wide below coxa IV at widest point, not extending anteriorly toward coxa and with irregular posterior margin. With four pairs of sternal setae, genital setae distinct. Sternal setae I 69 (67-73) μ apart, sternal setae I and III 100 (99-102) μ apart. Paranal setae 34 (33-38) μ long, postanal seta 53 (52-58) μ long. Numerous setae distributed on opisthogastric region of holoventral shield extending anteriorly to the level of coxa IV. Peritreme short, 93 (91-99) μ long, extending anteriorly to level between coxae II-III. Peritrematal shield posteriorly free from holoventral shield.

Thickened leg II (fig. 3 m) bears stout, unilaterally basally swollen ventral setae as follows: One on femur v_3 , one on genu av , one on tibia av , and one on tarsus av_2 . Tarsal length/width as follows: Leg I 3.1, Leg II 2.6, Leg III 3.5, and Leg IV 5.4.

TYPES — The holotype female is on a slide marked "on *Cryptotis parva*, Thomasville, Ga., January 13, 1937, E. V. Komarek, Bish. 26946" (USNM). Paratypes seen: GEORGIA: Clariton Co., 4 miles west Folkston, on female *Scalopus aquaticus australis*, 10 Jan. 1936, (3 females and 3 nymphs on same slide) (USNM).

REMARKS — *Haemogamasus harperi* most closely resembles *H. keegani* Jameson but differs in the female possessing a small number of sternal accessory setae and the second cheliceral segment about eleven times longer than wide; the male holoventral shield only slightly and irregularly expanded below coxae IV. *Haemogamasus keegani* females have no sternal accessory setae, the second cheliceral segment about seven times longer than wide, and the male holoventral shield considerably expanded below and toward coxae IV.

DISTRIBUTION — Southeastern United States.

ADDITIONAL SPECIMENS EXAMINED — FLORIDA: Putnam Co., Welaka, on *Scalopus aquaticus australis* M 255, V-27-1947, (2 females). GEORGIA: Decatur Co., on *Scalopus p. howelli*, III-11-1947, (1 female); same, on mole V-6-1947, (1 female); same, on mole IV-2-1947, (1 nymph). Glynn Co., St. Simmons Island on *Scalopus aquaticus australis* II-21-1952 (1 male TTU); Oatland Island, on Fla. mole No. 309, VIII-26-1949 (2 females, 1 male TTU on separate slides); Oatland Island, on Fla. mole V-7-1948, (1 female). LOUISIANA: East Baton Rouge Parish, on eastern shrew mole *Scalopus aquaticus*, VIII-1970, (3 females, 2 males OSU).

MISSISSIPPI: "mole, MSC, X-31-37," (2 males on separate slides). SOUTH CAROLINA: Charleston Co., Charleston, on common mole, VII-1930, (4 females same slide). TEXAS: Liberty Co., two miles East Romayer, on *Scalopus aquaticus*, XI-4-1957, (1 female).

Haemogamasus keegani (Jameson)
(Figs. 4 a-n)

Euhaemogamasus keegani Jameson, 1952: 600.

Euhaemogamasus liponyssoides occidentalis Keegan, 1951: 255 (in part, 3 females illustrated and discussed).

Haemogamasus keegani (Jameson): Strandtmann and Wharton, 1958: 133.

DIAGNOSIS — A medium sized species of the *liponyssoides* group, characterized by the sternal shield invaginated outside sternal setae III with no sternal accessory setae and a relatively narrow male holoventral shield.

FEMALE — Described from the female holotype, one paratype and three additional specimens.

Cheliceral segment I 116 (110-131) μ long, segment II 262 (247-291) μ long, movable digit (fig. 4 a) 102 (87-102) μ long, slender and curved. Fixed digit very slender, curved, appears shorter than movable digit. *Pilus dentilis* minute, setiform at base of distal curvature. Dorsal seta absent. Dorsal and lateral lyriform fissures indistinct. Capitular setae 73 (67-76) μ apart, hypostomal setae II 58 (55-61) μ apart. Deutosternal groove parallel sided (fig. 4 b) with 10 to 11 rows of denticles, 1-4 per row. Corniculi 61 (58-67) μ long. Tectum (fig. 4 c) slender, triangular with long slender branched or unbranched distal fimbriae. Pedipalp with two-tined apotele; trochanteral seta v_2 broad; genu with seta al_1 thickened.

Dorsal shield 936 (936-1044) μ long by 540 (504-660) μ wide, thinly covered with setae mostly of uniform length, few anterior setae barbed. Tritosternum with base 58 (49-58) μ long, laciniae unmeasurable on specimens examined. Presternal area lacking small teeth on reticulations. Sternal shield (fig. 4 d) 134 (131-146) μ long by 174 (166-180) μ wide anteriorly and 231 (210-245) μ wide posteriorly with stout sternal setae, without accessory setae. Sternal setae I 87 (70-87) μ apart, sternal setae I and III 116 (105-116) μ apart. Posterior concavity extending anteriorly nearly to or to level of sternal setae III, 17 (17-35) μ long by 122 (102-128) μ wide. Genitoventral shield (fig. 4 e) narrow, flask-shaped, slightly swollen base, 367 (367-399) μ long, including anterior flap, by 134 (111-134) μ wide, 12 (11-15) accessory setae on posterior one-half of shield. Anal shield (fig. 4 f) 189 (183-194) μ long by 99 (93-105) μ wide and 7 (rarely 6) accessory setae. Paranal setae 58 (55-61) μ long, postanal seta 79 (76-81) μ long. Small variable metapodal shields posterior to coxae IV. Stigma at anterior edge of coxa IV with short peritreme extending anteriorly to level of coxa III, 116 (113-148) μ long. Anterior tip of peritrematal shield appears free from dorsal shield, posterior portion free from podal shields of coxa IV.

Tarsi abruptly narrowed distally. Tarsus IV (fig. 4 g) with seta pd_2 slightly longer than other setae. Tarsal length/width as follows: Leg I 3.9, Leg II 2.8, Leg III 5, and Leg IV 7.

MALE — The following description is based on one male paratype, similar to females except as follows:

Cheliceral segment I 76 μ long, segment II 175 μ long. Movable digit together with spermadactyl 73 μ long, digitiform spermadactyl hyaline (fig. 4 h). Fixed digit shorter than movable digit with setiform *pilus dentilis*. Dorsal seta absent. Dorsal and lateral lyriform fissures indistinct. Capitular setae 58 μ apart, hypostomal setae II 52 μ apart. Deutosternal groove (fig. 4 i) parallel sided with 10 rows of denticles, 3-5 per row. Corniculi blunt, 35 μ long.

Dorsal shield 852 μ long by 516 μ wide. Tritosternum base 41 μ long, laciniae 108 μ long.

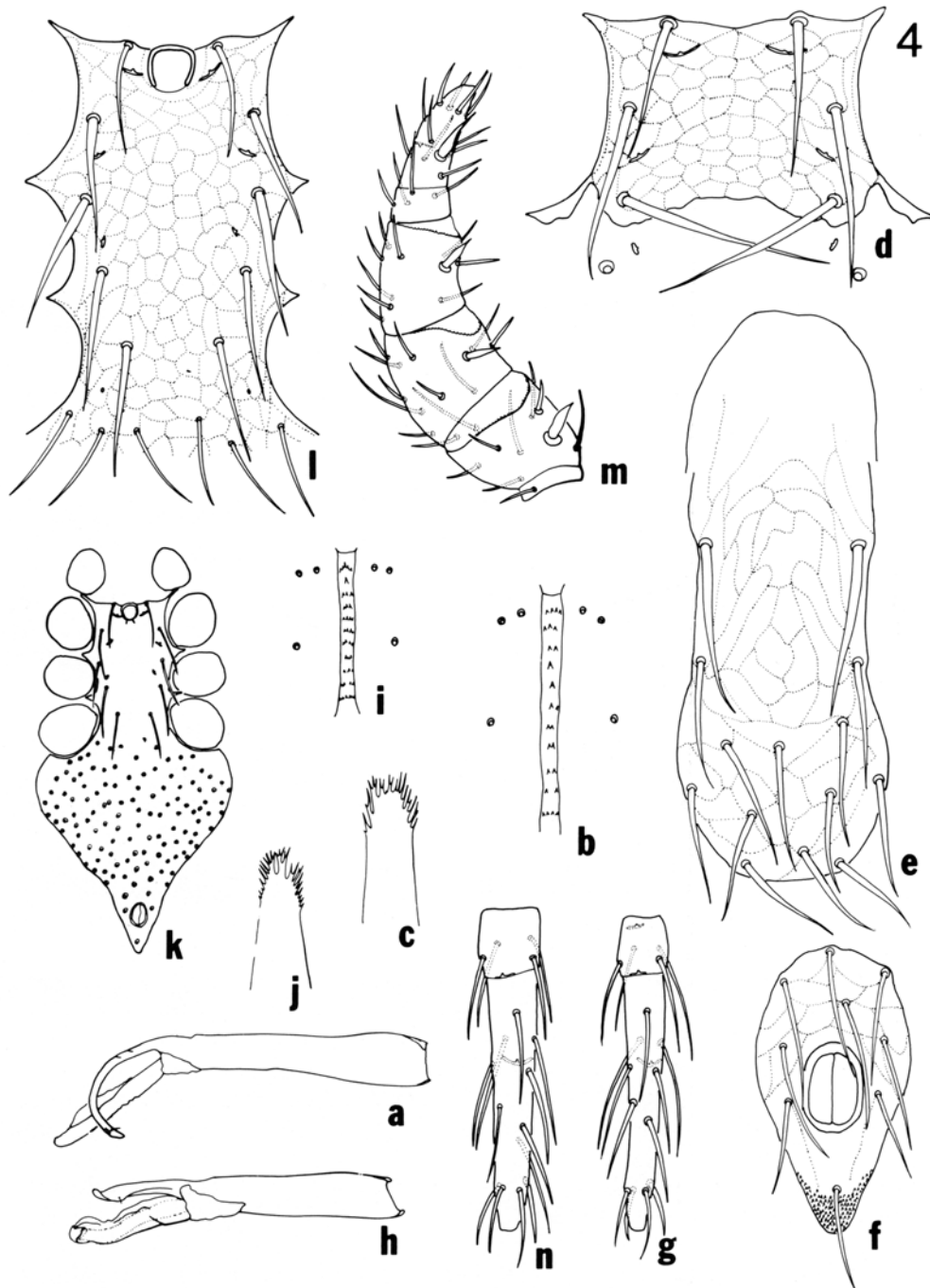


Fig. 4: *Haemogamasus keegani* (Jameson), a-g female, h-n male: a, chelicera lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genito-ventral shield; f, anal shield; g, tarsus IV ventral view; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-ventral view; n, tarsus IV-ventral view.

Presternal area with tiny blunt teeth. Holoventral shield (figs. 4 k,l) 655 μ long by 146 μ wide at level of genital opening and 358 μ wide at widest point, extending laterally past mid coxa IV but not extending anteriorly outside coxae, with four pairs sternal setae, genital setae distinct. Sternal setae I 52 μ apart, sternal setae I and III 96 μ apart. Paranal setae 41 μ long, postanal seta 45 μ long. Numerous accessory setae distributed on opisthogastric region of holoventral shield extending anteriorly below or to level of genital setae. Peritreme 87 μ long, extends anteriorly to level between coxae II and III. Peritrematal shield not fused to holoventral shield. Small metapodal shield posterior to coxa IV.

Thickened leg II (fig. 4 m) bears stout basally swollen, ventral setae as follows: One on femur v_3 , one on genu av , one on tibia av and one on tarsus av_2 . Tarsal length/width as follows: Leg I 3.1, Leg II 3.2, Leg III 3.6, and Leg IV 6.3.

TYPES — The holotype female is on a slide marked "*Sorex trowbridgii*, California, Plumas Co., Quincy, 19 July 1951, coll. E. W. Jameson, Jr." (USNM). Paratypes seen: CALIFORNIA: Plumas Co., Quincy, on *Sorex trowbridgii*, 19 Mar. 1951 (1 male); 5 miles E. Quincy, on *Sorex trowbridgii*, 30 Nov. 1950. (1 female) (USNM).

REMARKS — *Haemogamasus keegani* closely resembles *H. harperi* Keegan but may be separated by the following characters: Sternal shield with no accessory setae, female second cheliceral segment about seven times longer than wide and male holoventral shield greatly and regularly expanded below and toward coxae IV. *H. harperi* females possess a small number of sternal accessory setae, the female second cheliceral segment about eleven times longer than wide and the male holoventral shield is slightly and irregularly expanded below coxae IV.

DISTRIBUTION — Western United States.

ADDITIONAL SPECIMENS EXAMINED— OREGON: Lake Co., on *Scapamus townsendi*, XI-7-1934, (3 females, 1 nymph—same slide, labelled paratypes of *H. i. occidentalis*).

Haemogamasus occidentalis (Keegan)
(Figs. 5 a-n)

Euhaemogamasus lipomyssoides occidentalis Keegan, 1951: 225; Jameson, 1952: 600.

Haemogamasus occidentalis (Keegan): Strandtmann and Wharton, 1958: 135; Radovsky, 1960: 401.

DIAGNOSIS — A large species of the *lipomyssoides* group characterized in both sexes by long distal and (when present) short lateral fimbriae on the tectum; evenly interspersed long and short setae on the dorsal shield; females with posterior margin of sternal shield nearly straight, about 30 genitoventral accessory setae; male spermadactyl slightly curved and sclerotized.

FEMALE — Described from the holotype and five additional specimens.

Cheliceral segment I 131 (125-146) μ long, segment II 309 (282-309) μ long. Movable digit (fig. 5 a) 102 (93-102) μ long, edentate, grooved on inner surface. Fixed digit edentate, curved, with a small setiform *pilus dentilis*, dorsal seta small. Dorsal and lateral lyriform fissures indistinct. Capitular setae 73 (73-82) μ apart, hypostomal setae II 64 (58-67) μ apart. Deutosternal groove (fig. 5 b) narrowed medially with 12-14 transverse rows of denticles, 4-9 per row. Corniculi 58 (55-61) μ long. Tectum narrow (fig. 5 c) triangular with long simple or branched fimbriae anteriorly. Pedipalp with two-tined apotele; trochanteral seta v_2 broad; genu with seta al_1 thickened.

Dorsal shield 1164 (1164-1260) μ long by 672 (648-720) μ wide, covered with evenly interspersed long and short setae. Inconspicuous pores scattered over shield surface. Tritosternum base 44 (35-58) μ long, laciniae 178 (146-190) μ long. Presternal area with numerous small

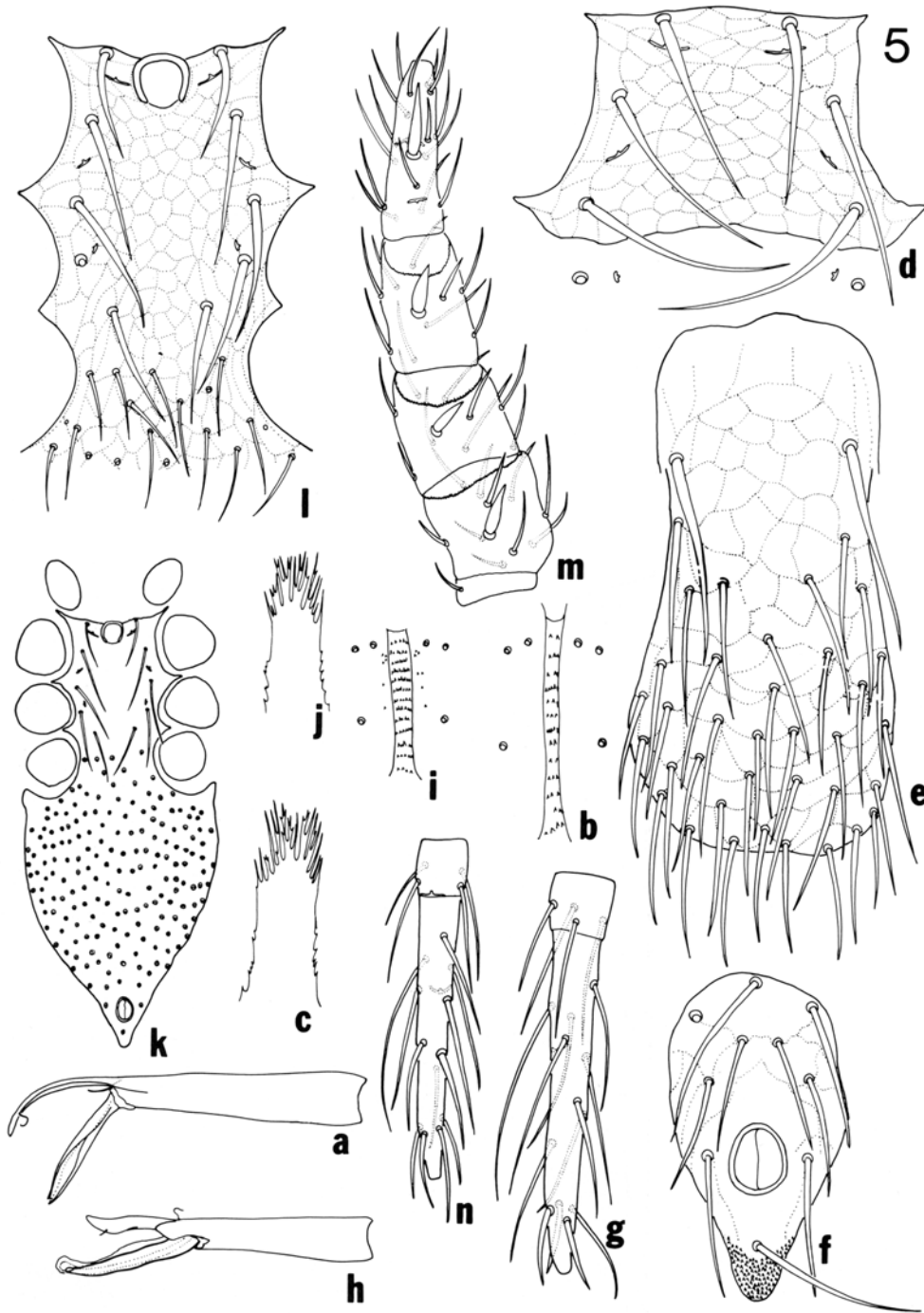


Fig. 5: *Haemogamasus occidentalis* Keegan, a-g female, h-n male: a, chelicera lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genito-ventral shield; f, anal shield; g, tarsus IV-lateral view, dorsal surface on left; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holovertral shield; l, sternal area of holovertral shield; m, leg II-ventral view; n, tarsus IV-ventral view.

teeth on reticulations. Sternal shield (fig . 5 d) 181 (181-196) μ long by 181 (181-210) μ wide anteriorly and 286 (277-311) μ wide posteriorly without accessory seta. Sternal setae I 96 (72-96) μ apart, sternal setae I and III 151 (128-151) μ apart. Posterior concavity extends anteriorly to below sternal setae III, 18 (13-20) μ long by 166 (119-166) μ wide. Genitoventral shield (fig . 5 e) narrow, flask-shaped, 413 (381-439) μ long, including anterior flap, by 190 (172-196) μ wide at base, 37 (32-37) accessory setae on posterior one-half of shield. Anal shield (fig . 5 f) 248 (248-277) μ long by 128 (128-148) μ wide. Paranal setae 116 (111-116) μ long, postanal seta 134 (134-179) μ long. Small elongate metapodal shield posterior to coxa IV. Stigma at anterior edge of coxa IV with peritreme 260 (193-262) μ long, extending anteriorly to mid coxa II. Anterior tip of peritrematal shield appears free from dorsal shield, posterior edge of shield free.

Tarsus IV with seta pd_2 long and conspicuous (fig . 5 g). Tarsal length/width as follows: Leg I 4. 8, Leg II 3. 6, Leg III 4. 9, and Leg IV 7. 9.

MALE — Based on four specimens similar to female except as follows:

Cheliceral segment I 99 (87-108) μ long, segment II 204 (183-274) μ long. Movable digit edentate, 93 (87-99) μ long and stouter than fixed digit (fig . 5 h). Movable digit and spermadactyl together 95 (89-101) μ long with moderately developed spermadactyl slightly curved over movable digit. Fixed digit edentate, slender and curved with small filiform *pilus dentilis* near distal curve. Dorsal seta small, setiform. Dorsal and lateral lyriform fissures indistinct. Capitular setae 67 (58-79) μ apart, hypostomal setae II 64 (58-67) μ apart. Deutosternal groove narrowed medially with 11-15 transverse rows of denticles, 4-9 per row (fig . 5 i). Corniculi blunt 47 (44-50) μ long.

Dorsal shield 1080 (1020-1164) μ long by 636 (576-720) μ wide. Tritosternum base 27 (26-32) μ long, laciniae 148 (143-157) μ long. Holoventral shield 871 (810-914) μ long by 169 (167-171) μ wide at level of genital opening and 396 (394-419) μ wide below level of coxae IV, extending laterally around coxa to mid coxa (figs. 5k, l), with four pairs of sternal setae, genital setae distinct. Sternal setae I 77 (73-82) μ apart, sternal setae I and III 119 (111-128) μ apart. Paranal setae 61 (55-64) μ long, postanal seta 64 (58-87) μ long. Numerous setae distributed on opistogastric region of holoventral shield, extending anteriorly to midcoxae IV below genital setae. Peritreme 174 (160-193) μ long, extending anteriorly to level of coxae II. Peritrematal shield unfused with holoventral shield.

Thickened leg II (fig . 5 m) bears evenly tapered stout ventral setae as follows: One on femur v_3 , one on genu av , one on tibia av and one on tarsus av_2 . Tarsal length/width as follows: Leg I 4. 4, Leg II 4, Leg III 4. 8, and leg IV 7. 3.

TYPES — The holotype female, along with a paratype male, is on a slide marked "in nest of *Microtus townsendi* Oregon, Portland, 12-24-31, S. G. Jewett, Jr., Bish. No. 16610, USNM Type No. 1866". (USNM). Paratypes seen: OREGON: Multnomah Co., Portland, in nest of *Microtus townsendi*, 24 Dec. 1931 (1 male, on slide with holotype female); WASHINGTON: Cowlitz Co., Castle Rock, on townsend mole, 30 Mar. 1927 (2 nymphs).

REMARKS— *Haemogamasus occidentalis* closely resembles *H. ghanii* but may be separated by the following characters: evenly interspersed long and short setae on the dorsal shield; females with nearly straight posterior margin of sternal shield, and large number of genitoventral accessory setae; males with narrow second cheliceral segment.

Haemogamasus ghanii possesses dorsal setae mostly of one size; female with posterior margin of sternal shield invaginated nearly to sternal setae III and smaller number of genitoventral accessory setae; the male with stout second cheliceral segment.

Keegan (1951) originally described *H. occidentalis* as a subspecies of *H. liponyssoides*. Strandtmann and Wharton (1958) gave it species rank without comment.

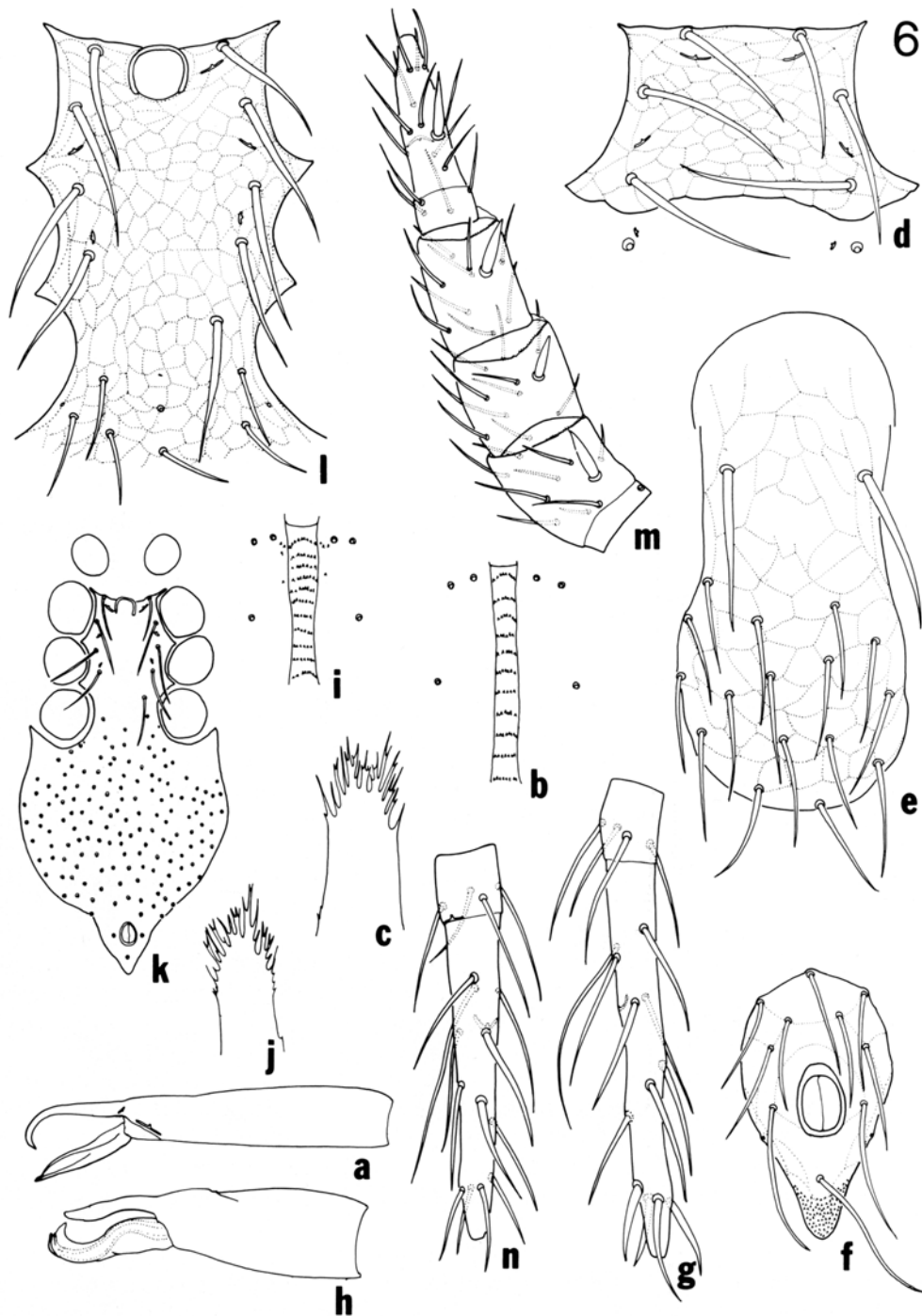


Fig. 6: *Haemogamasus ghami* Williams, n. sp., a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield, e, genito-ventral shield; f, anal shield; g, tarsus IV-lateral view, dorsal surface on left; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-ventral view; n, tarsus IV-ventral view.

DISTRIBUTION—*Haemogamasus occidentalis* is known from the north-western United States and southwestern Canada.

ADDITIONAL SPECIMENS EXAMINED — CALIFORNIA: Mono Co. , Cottonwood Basin, White Mts. on *Microtus* spp. , VI-21-1954, (3 females, 6 males, 6 nymphs on three slides UCB). OREGON: Benton Co. , on *Scapamus orarius* VII-4-1954, (7 females, 2 males on separate slides); Coos Co. , Coquille, on *Scapamus townsendi* IX-24-1953, (1 female, 2 males, 3 deutonymphs on same slide); Linnton, on *Mustela saturata* V-22-1938 (1 female, 1 male on same slide); Tillamook Co. , Netarts, on Oregon mole *Neotrichus* sp. III-24-1930, (two females-same slide). WASHINGTON: Clallam Co. , Hurricane Ridge, on *Scapamus (townsendi)* X-15-1950, (2 females, 2 males, 1 nymph on two slides); Thurston Co. , Olympia, on *Scapamus orarius* (coast mole) (2 females); Olympia, VIII-11-1926, (2 deutonymphs). BRITISH COLUMBIA: Vancouver, on *Scapamus orarius schefferi* III-29-1938 (1 female, 1 male, 1 nymph-same slide); Vancouver, on *Scapamus o. orarius*, X-19-1937, (1 female, 1 male, 1 nymph-same slide TTU).

Haemogamasus ghanii Williams, n. sp.

(Figs. 6 a-n)

DIAGNOSIS — A large species of the *liponyssoides* group distinguished by its size, heavy overall sclerotization, large hind tarsi; also the female with posterior margin of the sternal shield invaginated nearly to the level of sternal setae III; the male with second cheliceral segment stout and spermadactyl curved and sclerotized.

FEMALE — This description is based on the holotype and four paratypes.

Cheliceral segment I 116 (116-146) μ long, segment II 291 (286-311) μ long. Movable digit (fig . 6 a) 90 (87-93) μ long, edentate and curved, grooved on inner surface. Fixed digit very slender, equal to or longer than movable digit and sharply curved at tip. Dorsal and lateral lyriform fissures distinct. Capitular setae 102 (82-102) μ apart, hypostomal setae II 79 (58-84) μ apart. Deutosternal groove (fig . 6 b) parallel sided with 10-12 transverse rows of denticles, 4-12 per row. Corniculi 61 (58-64) μ long. Tectum triangular, (fig . 6 c) nearly parallel sided with long branched and unbranched anterior fimbriae and few small lateral projections. Pedipalp with two-tined apotele; trochanteral seta v_2 broad; genu with al_1 thickened.

Dorsal shield 1296 (1224-1296) μ long by 840 (720-840) μ wide, covered with setae mostly of uniform length, few scattered setae barbed. Tritosternum base folded on holotype and 50-55 μ long on other specimens, laciniae folded on holotype, 192-227 μ long on other specimens. Pre-sternal area with stout broad teeth on reticulations. Sternal shield (fig . 6 d) 174 (169-190) μ long by 204 (201-219) μ wide anteriorly and 291 (277-320) μ wide posteriorly without accessory setae. Sternal setae I 102 (93-105) μ apart, sternal setae I and III 146 (134-146) μ apart. Posterior concavity extending anteriorly to about level of sternal setae III, 20 (18-29) μ long by 187 (157-187) μ wide. Genitoventral shield (fig . 6 e) narrow flask shaped with slightly swollen base, 437 (410-446) μ long, including anterior flap, by 216 (186-229) μ wide at base, 19 (16-20) accessory setae on posterior one-half of shield. Anal shield (fig . 6 f) 282 (245-291) μ long by 146 (137-146) μ wide with 7 (holotype with 6) accessory setae. Paranal setae 87 (76-96) μ long, postanal seta lost in holotype and 140-154 μ long on other specimens. Small elongate metapodal shield posterior to coxa IV. Stigma at level of anterior edge of coxa IV with peritreme 257 (218-257) μ long, extending anteriorly to level of coxa II. Anterior tip of peritrematal shield appears free from dorsal shield, posterior part of shield free from coxa IV.

Tarsus IV (fig . 6 g) with pd_2 long. Tarsal length/width as follows: Leg I 4. 8, Leg II 4. 6, Leg III 5. 4, and Leg IV 8. 2.

MALE — The following is based on two paratypes. Measurements are given as minimum and maximum. Males similar to females except as follows:

Cheliceral segment I 116-131 μ long, segment II 244-247 μ long. Movable digit 98-102 μ long, thick and slightly sclerotized (fig. 6 h). Movable digit with spermadactyl together 111-114 μ long, spermadactyl heavily sclerotized with tip curved and bifid. Fixed digit nearly equal in length to movable digit, slender and curved. *Pilus dentilis* and dorsal seta absent. Dorsal and lateral lyriform fissures indistinct. Capitular setae 79-82 μ apart. Hypostomal setae II 73-76 μ apart. Deutosternal groove (fig. 6 i) parallel sided with 11-12 transverse rows of denticles with 6-12 per row, few denticles bordering groove anteriorly. Corniculi blunt, 61-64 μ long.

Dorsal shield 1128-1164 μ long by 636-780 μ wide. Tritosternum base 29-34 μ long, laciniae 146-151 μ long. Holoventral shield (figs. 6 k, l) 882-893 μ long by 131-160 μ wide at level of genital opening and 466-610 μ wide below coxa IV, extending laterally and anteriorly around coxa to mid-coxa. With four pairs sternal setae, genital setae distinct. Sternal setae I 82-96 μ apart, sternal setae I and III 111-116 μ apart. Paranal setae 87-91 μ long, postanal seta 87-102 μ long. Numerous setae distributed on opisthogastric region of holoventral shield, extending anteriorly to level of coxa IV below genital setae. Peritreme 148-166 μ long, extends anteriorly to hind edge of coxa II. Peritrematal shield not fused posteriorly to holoventral shield.

Thickened leg II (figs. 6 m), bears regularly tapered stout ventral setae as follows: One on femur v_3 , one on genu av , one on tibia av , and one on tarsus av_2 . Tarsal length/width as follows: Leg I 4. 7, Leg II 3. 9, Leg III 5, and Leg IV 6. 9.

TYPES — The female holotype, USNM No. 3752, is on a slide marked: Right label "*Clethrionomys rutilus*, Plot II H-1, Alaska, 21 Sept. 1966, Ghani", left label "*Haemogamasus ghani* Williams, holotype, USNM No. 3752". Paratypes, 4 females and 2 males as follows: ALASKA: Circle Hot Springs, on *Microtus oeconomus*, 30 Aug. 1964, (2 females, 1 male on separate slides); same data, 31 Aug. 1966 (1 female); Mile 10, Denali Hwy., on *Microtus miurus*, 20 Aug. 1964 (1 female); same data, 21 Aug. 1964 (1 male). (USNM).

REMARKS — This species closely resembles *H. occidentalis* but is distinguished by the female sternal shield with invaginated posterior margin, a small number of genitoventral accessory setae; the male with stout second cheliceral segment, the spermadactyl strongly curved; both sexes lacking a *pilus dentilis* and dorsal seta. *H. occidentalis* differs in the female sternal shield having a nearly straight posterior margin, a large number of genitoventral accessory setae; the male with slender second cheliceral segment, the spermadactyl slightly curved; both sexes having a small *pilus dentilis*.

DISTRIBUTION — Alaska.

ADDITIONAL SPECIMENS EXAMINED — ALASKA: Circle Hot Springs, on *Microtus oeconomus*, VIII-30-1964, (13 females and 2 males on separate slides); same data, IX-3-1964 (1 female); same data, VIII-31-1966 (4 females); Mile 10, Denali Hwy., on *Microtus miurus*, VIII-21-1964 (4 females).

ETYMOLOGY — This species is named for Mr. Hamid Majid Ghani, collector of the specimens.

REIDI GROUP

Medium to large *Haemogamasus*. Both sexes with some gnathosomal and most leg setae barbed, paired apical setae barbed. Females: Chelicerae stout and toothed, three pairs of sternal lyriform pores on shield, anal shield pyriform with one to six accessory setae (arrangement variable). Males: Chelicerae stout, toothed and greatly modified for sperm transfer.

Haemogamasus reidi Ewing
(Figs. 7 a-n)

Haemogamasus reidi Ewing, 1925: 140; Vitzthum, 1930: 404; Redington, 1970: 643.

Euhaemogamasus oregonensis Ewing, 1933: 5.

Euhaemogamasus sciuropteri Keegan, 1946: 72.

Euhaemogamasus ambulans (Thorell): Keegan, 1951: 228 (considered *H. reidi*, *H. ambulans*, *H. nidi*, *H. onychomydis* among others as junior synonyms of *E. ambulans* as described from *H. nidi* specimens from Europe).

Haemogamasus ambulans (Thorell) of Strandtmann and Wharton, 1958: 130; Furman, 1959: 274 (both after Keegan, 1951).

Haemogamasus nidi Michael: Bregetova, 1953: 316 (agreed in part with Keegan, 1951).

DIAGNOSIS — A medium sized species characterized in both sexes by a long, thin *pilus dentilis*, sparsely barbed leg setae and dorsal shield with few scattered posterior setae barbed.

FEMALE — Modified after Redington (1970) and based on the lectotype, six paralectotypes and two additional specimens.

Cheliceral segment I 94 (79-122) μ long, segment II 123 (113-166) μ long. Movable digit (fig. 7 a) 50 (46-61) μ long with two recurved teeth and ending in a single large tooth. Fixed digit with a proximal ridge, two strong teeth and ending in a single tooth. *Pilus dentilis* long, thin and strongly curved. Dorsal seta long, digitiform. Dorsal and lateral lyriform fissures distinct. All gnathosomal setae barbed. Capitular setae 82 (64-84) μ apart, hypostomal setae II 58 (49-64) μ apart. Deutosternal groove (fig. 7 b) nearly parallel sided with 11 (10-12) transverse rows of denticles, 2-5 per row. Corniculi 28 (27-44) μ long. Tectum (fig. 7 c) slender, triangular, with long anterior and posterior branched or unbranched fimbriae. Pedipalp with two-tined apotele; both trochanteral setae barbed.

Dorsal shield 809 (740-996) μ long by 450 (411-540) μ wide, densely covered with setae mostly of uniform length, some posterior and marginal setae barbed. Tritosternum base 37 (27-52) μ long, laciniae 143 (110-174) μ long. Presternal area with small teeth on reticulations. Sternal shield (fig. 7 d) 120 (114-140) μ long by 147 (123-168) μ wide anteriorly and 208 (157-260) μ wide posteriorly, without accessory setae. Sternal setae I barbed, 107 (96-110) μ apart, sternal setae I and III 103 (92-108) μ apart. Posterior concavity extending anteriorly to level between sternal setae II and III. Genitoventral shield (fig. 7 e) flask shaped 379 (364-404) μ long, including anterior flap, by 184 (168-192) μ wide at base, 24 (17-42) accessory setae on posterior two-thirds of shield. Anal shield (fig. 7 f) 127 (106-130) μ long by 106 (91-106) μ wide with 0 (0-6) accessory setae. Paranal setae barbed or unbarbed, 40 (37-58) μ long, postanal seta barbed 72 (52-87) μ long. Small variable metapodal shield posterior to coxa IV. Stigma at anterior edge of coxa IV, peritreme extending anteriorly to level of coxa II, 190 (145-200) μ long. Anterior tip of peritrematal shield appears free from dorsal shield, posterior end fused to podal shields of coxa IV.

Most leg setae barbed. Tarsus IV with seta pd_2 long (fig. 7 g). Tarsal length/width as follows: Leg I 4.5, Leg II 3.5, Leg III 4, and Leg IV 6.5.

MALE — The following slightly modified from Redington (1970) and based on four reared specimens, similar to females except as follows:

Cheliceral segment I 71 (62-78) μ long, segment II 123 (118-130) μ long. Movable digit (fig. 7 h) 45 (44-64) μ long with a small spur on leading edge. Movable digit with spermadactyl together 52 (50-53) μ long. Spermadactyl extends anteriorly from exterior face of movable digit and bends 90 degrees over digit. Fixed digit usually shorter than movable digit with a long curved digitiform *pilus dentilis*. All gnathosomal setae barbed. Capitular setae 78 (67-85) μ apart, hypostomal setae II 40 (37-42) μ apart. Deutosternal groove (fig. 7 i) with 10-13 transverse

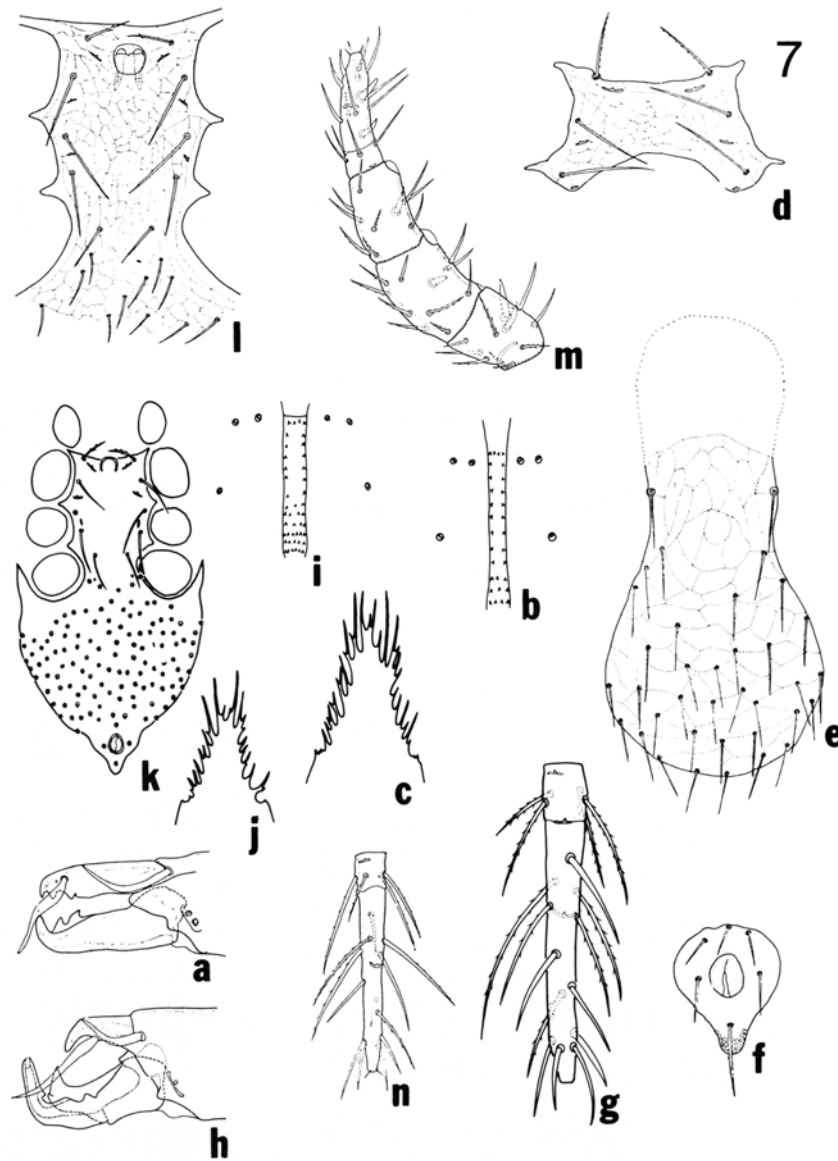


Fig. 7: *Haemogamasus reidi* Ewing, a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genito-ventral shield; f, anal shield; g, tarsus IV-ventral view; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holovenal shield; l, sternal area of holovenal shield; m, leg II-dorsal view; n, tarsus IV-dorsal view (a, d, e, f, h, l, m, n-from Redington, 1970).

rows of denticles, 2-7 per row. Corniculi blunt 22 (20-23) μ long. Pedipalp genu with al_1 thickened.

Dorsal shield 758 (712-809) μ long by 448 (392-504) μ wide with two large posterior pores, one on either side of midline. Tritosternum base 30 (25-35) μ long, laciniae 118 (99-130) μ long. Holoventral shield (figs. 7 k,l) 612 (567-678) μ long, 131 (120-138) μ wide at level of genital opening and 275 (240-289) μ wide below level of coxae IV, extending laterally and anteriorly around coxa nearly to anterior edge of coxa. Shield with four pairs of sternal setae, genital setae distinct. Sternal setae I barbed, 94 (87-100) μ apart, sternal setae I and III 111 (95-118) μ apart. Paranal setae 39 (37-40) μ long, postanal seta 58 (54-62) μ long. Numerous accessory setae on opisthogastric region of shield usually extending anteriorly to below level of sternal setae IV. Peritreme 122 (111-128) μ long. Peritrematal shield posteriorly fused to holoventral shield.

Thickened leg II (fig. 7 m) bears stout ventral setae as follows: Two on femur v_2 and v_3 , one on genu av , one on tibia av , and two on tarsus mv and av_2 . Tarsal length/width as follows: Leg I 4, Leg II 4, Leg III 5, 3, and Leg IV 8.

TYPES — The lectotype female (Redington, 1970) and six paralectotypes are on a single slide labelled: "Squirrel nest, Forestville, Md., 21 Apr. 1924, E. D. Reid, USNM No. 949". The lectotype is ringed in ink (USNM).

REMARKS — *Haemogamasus reidi* females closely resemble female *H. onychomydis* but the former may be separated by the long thin *pilus dentilis*, small corniculi (about 30 μ), sparsely barbed leg setae and few posterior dorsal setae barbed, while the latter possess a small setiform *pilus dentilis*, large corniculi (about 60 μ), thickly barbed leg setae and all dorsal setae barbed.

Haemogamasus reidi is surrounded by a great deal of confusion in the literature with synonyms being created on the basis of shield shapes and numbers of setae. Redington (1970) summarized the synonymies and history of *H. reidi* in American literature.

DISTRIBUTION — Known from much of Canada and over most of the United States.

SPECIMENS EXAMINED IN ADDITION TO REDINGTON (1970) — CALIFORNIA: Alameda Co., Strawberry Canyon, on *Neotoma* sp., III-12-1957, (1 female and 1 male on same slide UCB); Calaveras Dam area, on *Microtus californicus*, III-22-1945, (1 female UCB); Calaveras Dam, on *Microtus californicus*, IV-14-1945, (1 female); Butte Co., 1.5 mi. S.W. Cohasset, in *Neotoma* sp. nest, I-27-1959, (3 females and 3 males on same slide UCB); Contra Costa Co., El Cerrito, on *Neotoma*, XI-23-1962, (1 female and 1 male on same slide UCB); Los Angeles Co., Tanbark Flat, on *Neotoma fuscipes*, VI-26-1952, (1 female UCB); on *Neotoma fuscipes*, VI-28-1952, (1 female UCB); Mono Co., White Mts., Cottonwood Basin, on *Sorex palustris*, VI-21-26-1954, (1 female UCB); Cottonwood Basin, on *Microtus longicaudus* VI-22-26-1954, (1 female UCB); Monterey Co., Monterey, 5 mi. E. Salinas Rd., on *Microtus*, XI-15-1948, (1 nymph); Plumas Co., Quincy, on *Peromyscus (boylit)* I-14-1959, (1 female UCB); San Mateo Co., on *Microtus californicus*, VII-5-1948, (1 female UCB); Shasta Co., Summit City, in *Neotoma* nest, I-28-1959, (1 female UCB). MARYLAND: Calvert Co., Solomons, in squirrel nest, VII-19-1954 (1 female OSU); Prince Georges Co., Bowie, Pat. Res. Ref. in grey squirrel nest, V-22-1943, (2 females, 1 nymph, same slide OSU); Prince Georges Co., College Park, on squirrel, IX-1973, (1 female); NEW YORK: Tompkins Co., Ithaca, on *Tamiasciurus loquax*, III-2-1953, (5 males, same slide); Tompkins Co., on *Tamiasciurus loquax*, II-5-1953, (2 females). OHIO: Fairfield Co., Barneby Center, on *Glaucomys* II-29-1972, (2 females on separate slides OSU). OREGON: Tillamook Co., Tillamook, on *Phenacomys silvicola* III-6-1959, (2 females on same slide UCB). WASHINGTON, D.C.: Nat. Zool. Park, in squirrel nest, VIII-6-1955, (1 female and 1 male, same slide OSU).

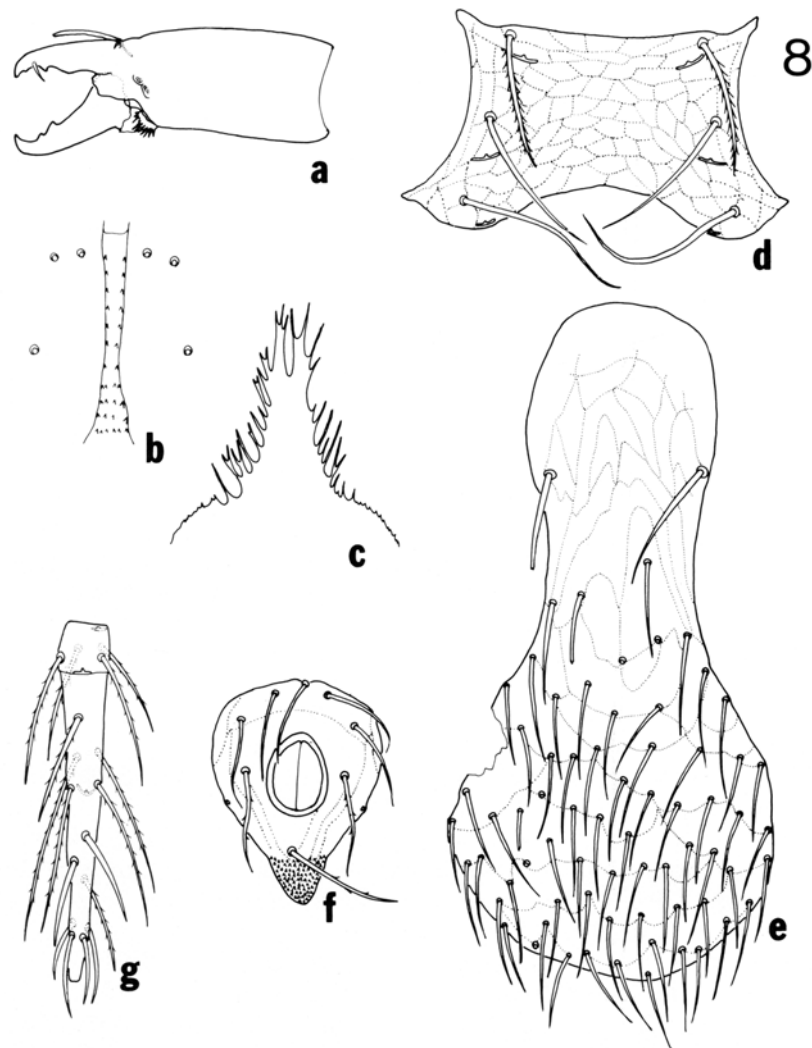


Fig. 8: *Haemogamasus onychomydis* (Ewing), a-g female: a, chelicera lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genitoventral shield; f, anal shield; g, tarsus IV ventral view.

Haemogamasus onychomydis (Ewing)
(Figs. 8 a-g)

Euhaemogamasus onychomydis Ewing, 1933: 4.

Euhaemogamasus ambulans (Thorell): Keegan 1951: 228 (in part, see *H. reidi*).

Haemogamasus ambulans (Thorell): Strandtmann and Wharton, 1958: 130, Furman, 1959: 274
(Both after Keegan, 1951).

Haemogamasus nidi Michael: Bregetova, 1953: 316 (after Keegan, 1951).

Haemogamasus onychomydis (Ewing): Redington, 1970: 643.

DIAGNOSIS — A medium sized species of the *reidi* group, characterized in the female by thickly barbed leg setae, all dorsal setae barbed, large corniculi (about 60 μ) and a short setiform *pilus dentilis*. The male is unknown.

FEMALE — Described from the holotype and thirteen other specimens.

Cheliceral segment I 108 (87-122) μ long, segment II 218 (180-233) μ long. Movable digit (fig. 8 a) 87 (73-87) μ long with two recurved teeth, the proximal larger and distal smaller, ending in a slightly bent claw. Fixed digit with proximal pointed ridge, two widely spaced distal teeth and ending in a large tooth. *Pilus dentilis* short, setiform. Dorsal seta long thin and slightly curved, extending anteriorly to middle of movable digit. Dorsal and lateral lyriform fissure distinct. Conspicuous brush border at base of movable digit. All gnathosomal setae barbed. Capitular setae 90 (79-97) μ apart, hypostomal setae II 70 (61-84) μ apart. Deutosternal groove (fig. 8 b) with 11 (10-12) transverse rows of denticles, 2-10 per row. Corniculi 70 (50-70) μ long. Tectum (fig. 8 c) triangular, deeply denticulate with many long, simple or forked anterior fimbriae and many small posterior projections. Pedipalp with two-tined apotele, both trochanteral setae barbed and *al*₁ on genu thickened.

Dorsal shield 1008 (792-1104) μ long by 552 (444-600) μ wide, densely covered with barbed setae mostly of uniform length. Several inconspicuous pores scattered over surface, two large pores located on posterior margin of shield, one on either side of midline. Tritosternum base 50 (44-64) μ long, laciniae long. Presternal area with numerous small teeth on reticulations. Sternal shield (fig. 8 d) 146 (134-166) μ long by 166 (151-199) μ wide anteriorly and 238 (221-273) μ wide posteriorly, without accessory setae. Sternal setae I barbed, 131 (108-134) μ apart, sternal setae I and III 116 (96-134) μ apart. Posterior concavity extending anteriorly to level between sternal setae II and III, 29 (18-32) μ long by 148 (131-157) μ wide. Genitoventral shield (fig. 8 e) flask shaped, 396 (349-454) μ long, including anterior flap, by 195 (157-210) μ wide at base, 70 (48-76) accessory setae on posterior two-thirds of shield. Anal shield (fig. 8 f) 143 (122-146) μ long by 96 (84-105) μ wide with 5 (4-6) accessory setae. Paranal setae barbed, 58 (52-61) μ long, postanal seta barbed, 70 (64-70) μ long. Small variable metapodal shield posterior to coxa IV. Stigma at anterior edge of coxa IV with peritreme 258 (200-306) μ long, extending anteriorly to level of coxa II. Anterior tip of peritrematal shield appears free from dorsal shield, posterior part of shield free from podal shields of coxa IV.

Leg setae strongly barbed. Tarsus IV with seta *pd*₂ long (fig. 8 g). Tarsal length/width as follows: Leg I 5, Leg II 5, Leg III 7, and Leg IV 10.

MALE — Unknown.

TYPE — The holotype female is on a slide marked "Onychomys, Oraibi, Arizona, June 4, 1927, through Biol. Surv. Paul E. Trapier, USNM type No. 1068" (USNM).

REMARKS — The female of *H. onychomydis* closely resembles female *H. reidi* but may be separated by the following characters: setiform *pilus dentilis*, large corniculi (about 60 μ), thickly barbed leg setae and all dorsal setae barbed. *H. reidi* females possess a long curved digitiform *pilus dentilis*, smaller corniculi (about 30 μ), sparsely barbed leg setae and few

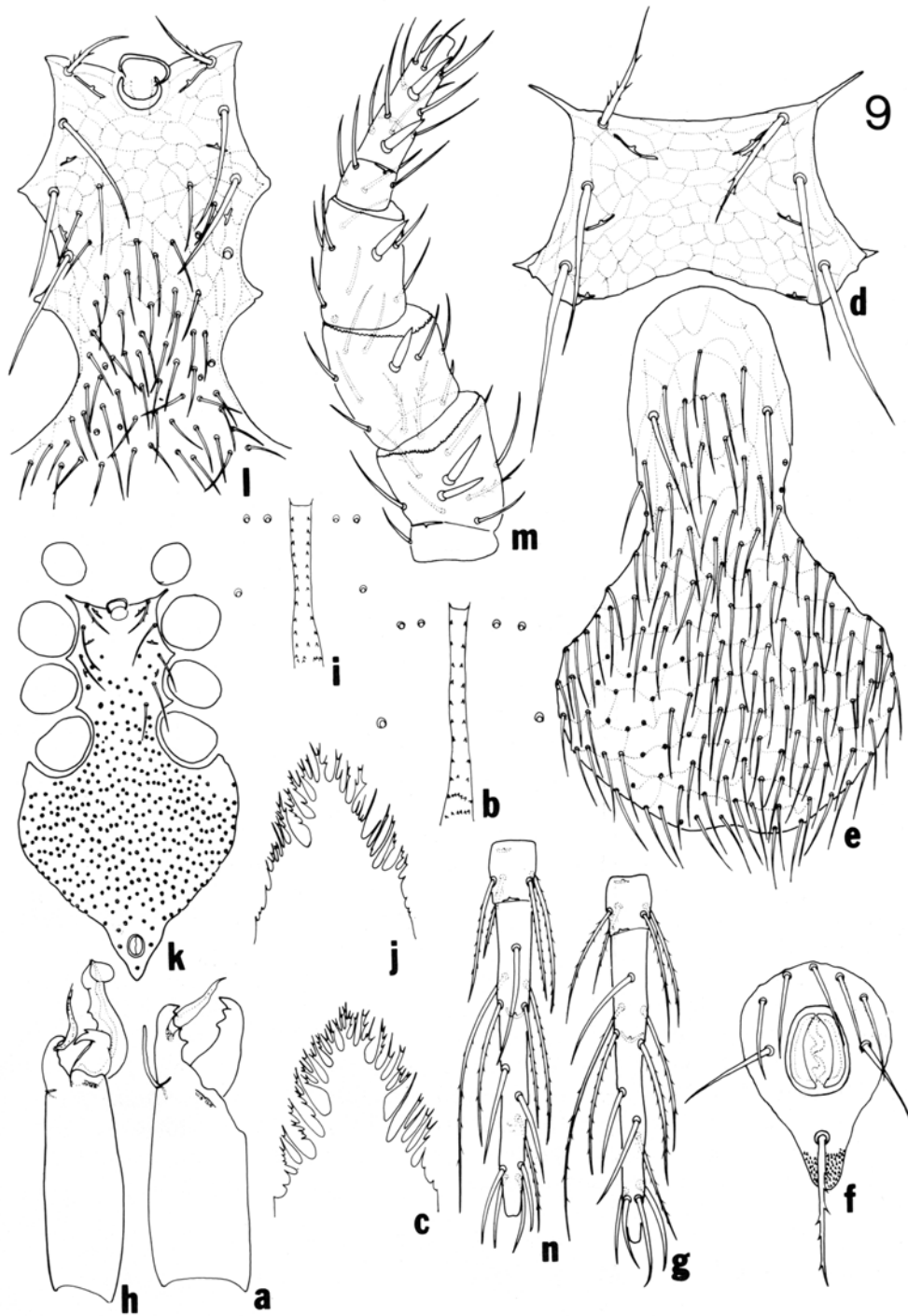


Fig. 9: *Haemogamasus longitarsus* (Banks), a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield, e, genital-ventral shield; f, anal shield; g, tarsus IV-ventral view; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoverntal shield; l, sternal area of holoverntal shield; m, leg II-ventral view; n, tarsus IV-ventral view.

posterior and marginal dorsal setae barbed.

This species was described by Ewing (1933) as the type-species of *Euhaemogamasus*. Keegan, (1951) synonymized it with several other species under *E. ambulans* (Thorell). Strandtmann and Wharton, (1958), following Keegan's lead, listed it as *Haemogamasus ambulans* (Thorell). Redington (1970) reinstated *H. onychomydis* as a senior synonym on the basis of corniculi, chelicerae and setae ornamentation.

DISTRIBUTION — *H. onychomydis* is known from the western United States. There is one record from Washington, D. C.

ADDITIONAL SPECIMENS EXAMINED — COLORADO: Costilla Co., Fort Garland, on *Thomomys talpoides* VII-1940, (1 female). OREGON: Harney Co., on *Microtus montanus*, VI-19-1953, (1 female); on *Onychomys palustris*, VIII-20-1953, (2 females, same slide); on *Onychomys* sp. IX-15-1954, (6 females on separate slides); on *Peromyscus maniculatus* no date, 1953, (2 females, on separate slides). UTAH: Salt Lake Co., on *Peromyscus maniculatus* (nest) (1 female). WASHINGTON, D. C.: on *Pitymys pinetorum* VI-25-1944, (1 female).

Haemogamasus longitarsus (Banks)
(Figs. 9 a-n)

Laelaps longitarsus Banks, 1910: 5.

Haemogamasus barberi Ewing, 1925: 140; Vitzthum, 1930: 404; Strandtmann and Wharton, 1958: 131.

Euhaemogamasus barberi (Ewing): Keegan, 1951: 249.

Haemogamasus microti Ewing, 1925: 141; Vitzthum, 1930: 404 (*E. barberi* of Keegan, 1951: 249).

Haemogamasus longitarsus (Banks): Johnston, 1959: 60; Whitaker and Wilson, 1974: 7.

DIAGNOSIS — A medium sized species of the *reidi* group distinguished by the female genitoventral shield broad, flask shaped with accessory setae extending to the front flap, and by the massive male spermadactyl curved and bulbous at the tip.

FEMALE — Described from the lectotype, one paralectotype and thirteen other specimens.

Cheliceral segment I 87 (87-146) μ long, segment II 181 (178-188) μ long. Movable digit (fig. 9 a) 58 (58-67) μ long with two equal teeth and ending in a single large tooth. Fixed digit with two equal teeth followed by a small tooth and ending in a single large tooth. *Pilus dentilis* large, expanded basally and irregularly curved. Dorsal seta long and usually extending to base of *Pilus dentilis*. Dorsal and lateral lyriform fissures distinct. All gnathosomal setae barbed. Capitular setae 116 (84-116) μ apart, hypostomal setae II 87 (67-87) μ apart. Deutosternal groove (fig. 9 b) nearly parallel sided with 10 (10-12) transverse rows of denticles, 2-7 per row. Corniculi 38 (38-44) μ long, pointed. Tectum (fig. 9 c) broadly triangular in outline, deeply denticulate with long simple or branched anterior fimbriae and many small posterior projections on each side. Pedipalp with two-tined apotele, both trochanteral setae barbed and genu with seta al_1 thickened.

Dorsal shield 1050 (1008-1140) μ long by 720 (648-780) μ wide, covered with setae mostly of uniform length, few anterior and marginal setae barbed. Two large outer pores and two inner nodules on posterior margin of shield, one on either side of midline. Tritosternum base 52 (52-64) μ long, laciniae 183 (160-189) μ long. Presternal area with numerous small stout teeth on reticulations. Sternal shield (fig. 9 d) 140 (140-169) μ long by 179 (165-189) μ wide anteriorly and 265 (248-274) μ wide posteriorly, without accessory setae. Sternal setae I barbed 134 (128-146) μ apart, sternal setae I and III 108 (105-122) μ apart. Posterior concavity extending anteriorly to or just past level of sternal setae III, 29 (20-32) μ long by 178 (168-181) μ wide. Genitoventral shield (fig. 9 e) very broad, flask shaped, 495 (460-530) μ long, including anterior flap, by 297 (297-355) μ wide at base, 131 (119-136) accessory setae, extending anteriorly nearly to front edge of shield. Anal shield (fig. 9 f) 160 (140-169) μ long by 108 (105-122) μ wide, with 5 (3-5)

accessory setae. Paranal setae 64 (58-69) μ long, postanal seta barbed, 99 (96-102) μ long. Small variable metapodal shield posterior to coxa IV. Stigma at anterior edge of coxa IV with peritreme 246 (234-291) μ long, extending anteriorly to level of coxa II. Anterior tip of peritrematal shield appears to end freely, posterior part of shield free or thinly attached to podal shields of coxa IV.

Most leg setae barbed. Tarsus IV (fig . 9 g) with seta pd_2 long. Tarsal length/width as follows: Leg I 4. 9, Leg II 4. 8, Leg III 6. 5, and Leg IV 10.

MALE — This description based on one paralectotype and three other specimens, similar to females except as follows:

Cheliceral segment I 73 (69-79) μ long, segment II 204 (128-225) μ long, movable digit (fig . 9 h) 49 (44-52) μ long with bifid tip. Movable digit with spermadactyl together 130 (128-134) μ long. Spermadactyl extends anteriorly from exterior face of movable digit, distal portion massive and curved with bulbous tip and extending past cheliceral digit by one length of movable digit. Fixed digit longer or equal to movable digit with long basally expanded hyaline *pilus dentilis*. Dorsal seta long, digitiform. Dorsal and lateral lyriform fissures distinct. Gnathosomal setae strongly barbed. Capitular setae 102 (99-108) μ apart and hypostomal setae II 87 (82-93) μ apart. Deutosternal groove parallel sided (fig . 9 i) with 10-12 rows of denticles, 2-6 per row. Corniculi blunt 41 (38-44) μ long.

Dorsal shield 948 (924-951) μ long by 524 (408-552) μ wide. Tritosternum base 44 (41-47) μ long, laciniae 163 (151-172) μ long. Presternal area with strong teeth. Holoventral shield (figs. 9 k, l) 675 (572-727) μ long by 160 (131-163) μ wide at level of genital opening and 373 (329-405) μ wide below level of coxae IV and extending laterally around coxae to outer margin, shield with four pairs of sternal setae, genital setae distinct. Sternal setae I barbed, 108 (105-114) μ apart, sternal setae I and III 101 (93-110) μ apart. Paranal setae 62 (53-67) μ long, postanal seta barbed 65 (58-70) μ long. Numerous accessory setae on opisthogastric region of holoventral shield, few extending anteriorly to level of sternal setae III. Peritreme 176 (161-191) μ long, extends anteriorly to level of coxa II. Peritrematal shield free posteriorly from holoventral shield.

Thickened leg II with stout ventral setae (fig . 9 m) as follows: Two on femur v_2 and v_3 , one on genu av , one on tibia av and two on tarsus mv and av_2 . Tarsal length/width as follows: Leg I 4, Leg II 4, Leg III 5. 3, and Leg IV 8.

TYPES — The lectotype female (Johnston, 1960) is on a slide marked "*Laelaps longitarsus*, in mole's nest, Falls Church, Va., Nov '1 (MCZ). Paralectotypes: Seven specimens, same data, on separate slides. (MCZ). Types of the junior synonyms *H. barberi* Ewing and *H. microti* Ewing have been examined and are in the USNM.

REMARKS — Both females and males of *H. longitarsus* closely resemble *H. thomomysi* Williams, n. sp. in the genitoventral shield shape and males possessing holoventral accessory setae to about the level of sternal setae III, but may be separated by genitoventral accessory setae reaching the front flap and the male's spermadactyl massive, curved and bulbous at tip. *H. thomomysi* females possess genitoventral accessory setae only to the level of genital setae and the male spermadactyl is long, thin and nearly straight.

DISTRIBUTION — Known from southeastern Canada and the eastern United States; specimens from western North America are most likely *H. thomomysi*.

ADDITIONAL SPECIMENS EXAMINED — DELAWARE: Kent Co., on pine mouse, VI-9-23-1939, (4 females-on two slides). MARYLAND: Montgomery Co., Burnt Mills, on pine mouse, B. M. 5, III-34-1932, (1 deutonymph); Cabin John, on pine mouse, VI-2-1932 (1 female); Maryland shore near Plummers Island, nest of small mammal, IV-27-1924, (2 females on separate slides,

each marked type of *H. barberi* USNM type No. 950); Prince George's Co. , Bowie on *Pitymys pinetorum*, V-20-1943, (2 females and 1 nymph); College Park, on pine mouse C. P. 57, IV-14-1932, (4 females); College Park, on pine mouse, V-9-1929, (1 female); College Park, on pine mouse, VI-14-1933, (1 female); Riverdale, on short-tail shrew, VI-27-1934, (3 females); University Park, on pine mice, VI-27-1936, (1 female). NEW HAMPSHIRE: Coos Co. , Mt. Washington, Lakes of Clouds, on *Clethrionomys gapperi ochraceus*, VII-1-1928, (1 male on slide with female *H. reidi*). NEW YORK: Westchester Co. , Bronxville on *Microtus pennsylvanicus*, II-18-1924, (2 females on same slide, types of *H. microti* USNM type No. 951). VIRGINIA: Fairfax Co. , Great Falls, from mouse nest, XII-26-1926, (1 male); Prince George Co. , Petersburg, on Albemarle meadow mouse, IV-6-1933, (1 female); Petersburg, on pine mouse, IV-7-1933 (1 male). WASHINGTON, D. C. : On *Pitymys pinetorum*, VI-25-1944, (2 females on separate slides). CANADA: Ontario, Welland Co. , Point Abino, on *Pitymys pinetorum*, IX-16-1945, (1 female); VIII-25-1946, (1 nymph).

Haemogamasus ambulans (Thorell)
(Figs. 10 a-n)

Dermanyssus ambulans Thorell, 1872: 166.

Gamasus ovalis Koch, 1878: 121.

Laelaps ovalis (Koch): Trägårdh, 1902: 61.

Hypoaspis ambulans (Thorell): Trägårdh, 1904: 1.

Haemogamasus alaskensis Ewing, 1925: 139; Vitzthum, 1930: 398.

Haemogamasus twitchelli Ewing, 1925: 142 (male holotype).

Haemogamasus sternalis Ewing, 1933: 3.

Haemogamasus ambulans (Thorell): Evans and Till, 1966: 244; Redington, 1970: 643 (not Keegan, 1951 or Strandtmann and Wharton, 1958).

DIAGNOSIS — A medium sized species of the *reidi* group, the female possessing numerous accessory setae on the sternal shield, the male bearing accessory setae on the holoventral shield to the level of sternal setae I, and both sexes with hypostomal setae I unbarbed.

FEMALE — Described from 17 specimens, mean measurements are followed by minimum and maximum in parentheses.

Cheliceral segment I 102 (90-116) μ long, segment II 140 (139-160) μ long. Movable digit (fig . 10 a) 49 (47-54) μ long with a proximal ridge, a distal tooth and ending in a large tooth. Fixed digit with three teeth, ending in a single tooth. *Pilus dentilis* setiform. Dorsal seta digitiform, long. Dorsal and lateral lyriform fissures distinct. Hypostomal setae I unbarbed, all other gnathosomal setae barbed. Capitular setae 86 (82-93) μ apart, hypostomal setae II 67 (58-73) μ apart. Deutosternal groove (fig . 10 b) narrowed medially with 10-12 transverse rows of denticles, 2-8 per row. Corniculi 38 (35-44) μ long, pointed. Tectum (fig . 10 c) triangular, with many long branched or unbranched anterior fimbriae and many small posterior projections. Pedipalp with two-tined apotele, both trochanteral setae barbed, genu with *al*₁ thickened.

Dorsal shield 1008 (840-1080) μ long by 588 (480-634) μ wide, covered with barbed or unbarbed setae mostly of uniform length. Two large outer pores and two inner nodules on posterior margin of shield. Tritosternum base 47 (38-58) μ long, laciniae 138 (125-175) μ long. Presternal area with blunt or pointed teeth on reticulations. Sternal shield (fig . 10 d) 150 (146-175) μ long by 166 (164-190) μ wide anteriorly and 233 (210-272) μ wide posteriorly, with 21 (12-32) accessory setae. Sternal setae I barbed 134 (113-151) μ apart, sternal setae I and III 119 (106-134) μ apart. Posterior concavity extending anteriorly to below level of sternal setae III, 20 (18-23) μ long by 137 (116-164) μ wide. Genitoventral shield (fig . 10 e) flask shaped 358 (335-378) μ long, including anterior flap, by 172 (145-195) μ wide at base, 55 (31-66) accessory setae on posterior two thirds of shield. Anal shield (fig . 10 f) 154 (140-175) μ long by 119 (90-148) μ wide with 5 (3-6) accessory setae. Paranal setae 64 (52-76) μ long, postanal seta barbed

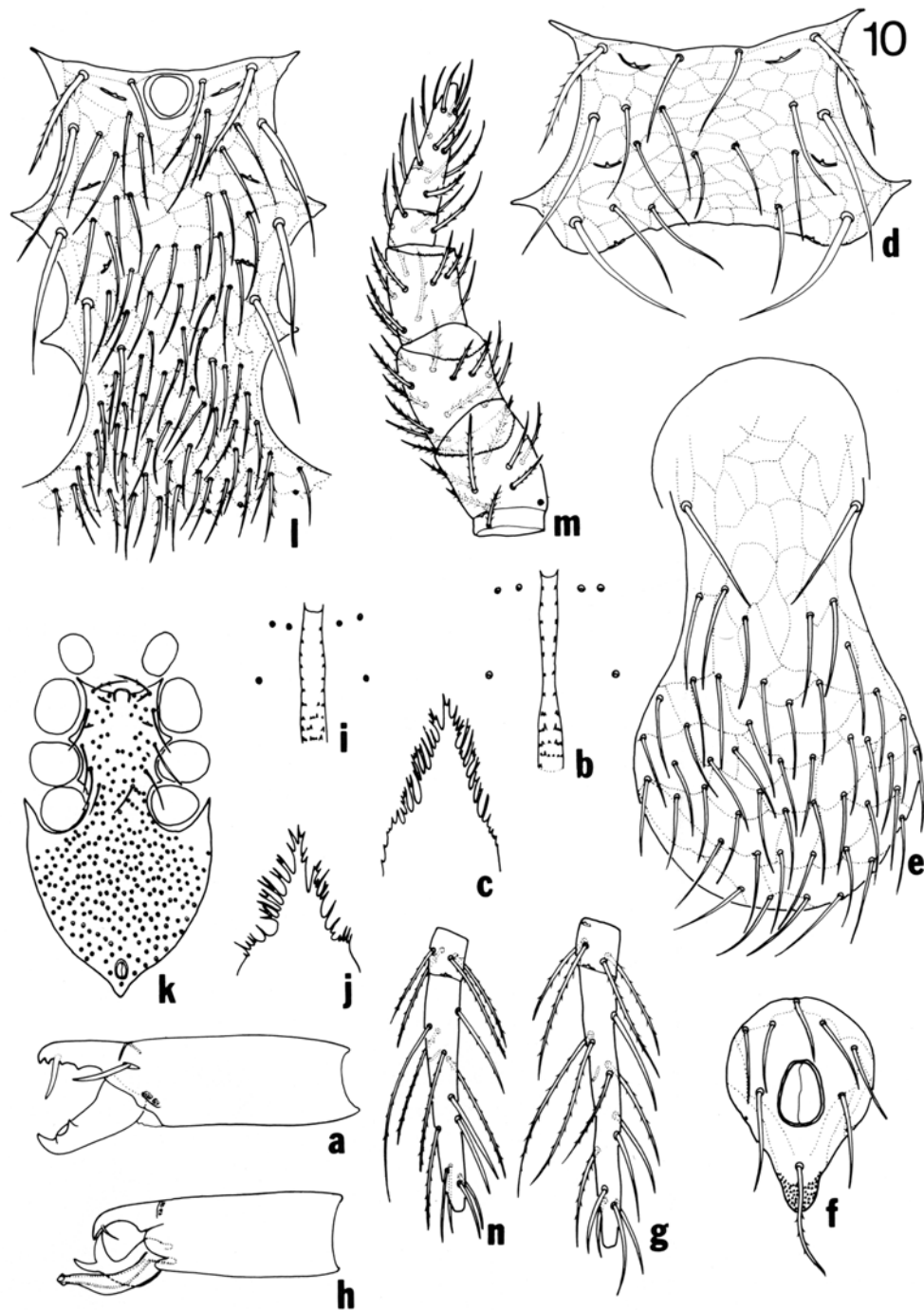


Fig. 10: *Haemogamasus ambulans* (Thorell), a-g female, h-n male; a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genitoventral shield; f, anal shield; g, tarsus IV-lateral view, dorsal surface on left; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holovenral shield; l, sternal area of holovenral shield; m, leg II-ventral view; n, tarsus IV-lateral view, dorsal surface on left.

73 (64-76) μ long. Small variable metapodal shield posterior to coxa IV. Stigma at anterior edge of coxa IV with peritreme 265 (227-294) μ long, extending to anterior edge of coxa II. Anterior tip of peritrematal shield free from dorsal shield, posterior end fused or unfused to podal shields of coxa IV.

Most leg setae barbed. Tarsus IV (fig. 10 g) with seta pd_2 long. Tarsal length/width as follows: Leg I 4.5-5.0, Leg II 4, Leg III 5.5, and Leg IV 8-9.

MALE — The following description is based on three specimens, similar to females except as follows:

Cheliceral segment I 61 (52-70) μ long, segment II 120 (111-128) μ long. Movable digit (fig. 10 h) 43 (41-49) μ long with large spur on leading edge. Movable digit with spermadactyl 46 (43-50) μ long. Spermadactyl extends anteriorly from exterior face of movable digit, the distal portion bent 45 degrees toward movable digit, extending past digit by one-fourth its own length. Fixed digit with one small blunt medial tooth and short setiform *pilus dentilis*. Dorsal seta digitiform. Dorsal and lateral lyriform fissures distinct. Hypostomal setae I unbarbed, all other gnathosomal setae barbed. Capitular setae 70 (64-76) μ apart, hypostomal setae II 55 (50-61) μ apart. Deutosternal groove parallel sided (fig. 10 i) with 10-12 rows of denticles, 2-7 per row. Corniculi blunt, 30 (29-32) μ long.

Dorsal shield 748 (732-756) μ long by 436 (432-444) μ wide, tritosternum base 34 (29-38) μ long, laciniae 105 (99-114) μ long. Holoventral shield (figs. 10 k, l) 560 (553-573) μ long by 139 (137-143) μ wide at the level of genital opening and 342 (335-348) μ wide below coxa IV, extending laterally around coxa anteriorly to mid-coxa. With four pairs sternal setae, genital setae slightly larger than surrounding setae. Sternal setae I barbed, 97 (93-102) μ apart, sternal setae I and III 94 (90-99) μ apart. Paranal setae 58 (52-64) μ long, postanal seta barbed 66 (64-76) μ long. Numerous setae distributed on opisthogastric region of holoventral shield and extending anteriorly to anterior edge of shield. Most posterior and many central accessory setae barbed. Peritreme 165 (143-189) μ long, extends anteriorly to level of coxa II. Peritrematal shield partially fused to holoventral shield.

Thickened leg II (fig. 10 m) without stout ventral setae. Tarsal length/width as follows: Leg I 4, Leg II 5, Leg III 4.5, and Leg IV 8.

TYPES — We have not studied the types of *Dermanyssus ambulans* or *Gamasus ovalis* because we believe these specimens to be lost or destroyed. Types of *Haemogamasus alaskensis*, *H. twitchelli*, and *H. sternalis* have been examined and are in the USNM.

REMARKS — *Haemogamasus ambulans* has long been confused with both a European species, *H. nidi* Michael and an American species, *H. reidi* Ewing, although the former has accessory sternal setae and the latter two do not. References to *H. alaskensis* or *H. sternalis* should be considered as *H. ambulans* while much of the American literature concerning *H. ambulans* actually refers to *H. reidi*. Redington (1970) summarized the synonymy and history of *H. ambulans*.

DISTRIBUTION — Worldwide, and in North America from most of Canada and the United States.

SPECIMENS EXAMINED — ALASKA: Ophir, Crater Mt., on *Microtus* sp., VIII-23-1924, (holotype female of *H. alaskensis* USNM No. 947); Ophir, Crater Mt., on Dawson red-back mole, VII-26-1924, (male holotype of *H. twitchelli* and female paratype, actually *H. reidi*, USNM No. 952); St. Lawrence Island, Gambell, on *Microtus oeconomus*, VII-1956, (7 females on separate slides); Umiat, on *Microtus* sp., V-6-1947, (1 female). ILLINOIS: Champaign Co., Urbana, on 3 B. b. and 2 P. l. n., X-18-1937, (1 female). MAINE: Piscataquis Co., Mt. Katahdin, Winday Pitch, on *Evotomys gapperi ochraceus*, VIII-23-1928, (1 male); Mt. Katahdin, Togwe Ponds, on

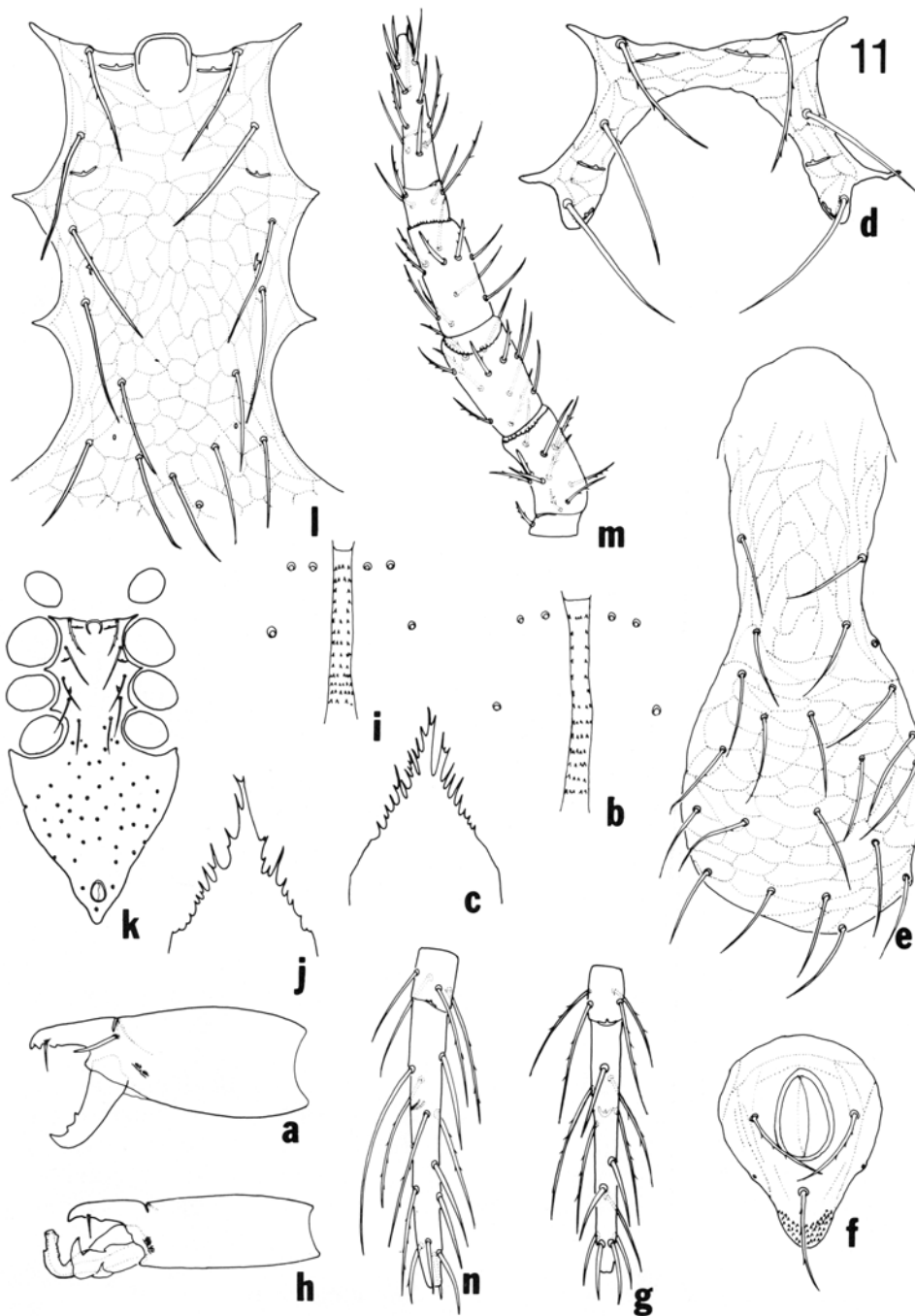


Fig. 11: *Haemogamasus pontiger* (Berlese), a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield, e, genito-ventral shield; f, anal shield; g, tarsus IV-ventral view; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-ventral view; n, tarsus IV-lateral view, dorsal surface on left.

Evotomys gapperi ochraceus, VIII-21-1928, (1 female). MARYLAND: Montgomery Co., Chevy Chase, on pine mouse, VI-7-1932, (1 female on slide with other sp.). MASSACHUSETTS: Barnstable Co., W. Falmouth, on *Microtus p. pennsylvanicus*, VI-8-1936, (2 females); Dukes Co., Edgartown, on *Microtus p. pennsylvanicus* VI-14-1936, (1 female); Gay Head, in nest of *Peromyscus* or *Microtus*, II-14-1939, (2 females on slide with 1 female *H. liponyssoides* TTU). MINNESOTA: Lake Co., on field mouse, IV-22-1931, (1 female). NEW YORK: Erie Co., 2 mi. N. Springville, on *Microtus pennsylvanicus*, VIII-29-1945, (1 female); Essex Co., Adirondack Lodge, from caudal region of *Blarina brevicauda talpoides*, VIII-12-1925, (female holotype of *H. sternalis*, USNM No. 1067); Tompkins Co., Ithaca, on *Tamiasciurus loquax*, VII-23-1952, (1 female, TTU). PENNSYLVANIA: Crawford Co., Pymatuning Res., on *Clethrionomys gapperi*, IX-12-1945, (1 female); Monroe Co., on *Microtus p. pennsylvanicus* 795, IV-24-1945, (1 female); on *Clethrionomys gapperi* 821, V-5-1945, (1 female); Pikes Co., on *Blarina brevicauda* # 2, X-7-1945, (1 female); Wayne Co., on *Clethrionomys gapperi* #877, VII-9-1945, (1 female). VERMONT: Orleans Co., on *Blarina brevicauda talpoides*- 2 males, IX-8-1932, (2 females); Jay Peak, on *Blarina brevicauda talpoides*, VIII-17-1927, (1 female). CANADA: British Columbia, Vancouver, U. of B. C. on *Lemmus*, VII-7-1959, (3 females, same slide); Ontario, Welland Co., Point Abino, on *Blarina brevicauda*, grassland, VIII-30-1946, (1 female); on *Blarina brevicauda*, woodlands, IX-4-15-1946, (3 females, 1 male, on separate slides); on *Pitymys pinetorum*, IX-4-1946, (1 female). CZECHOSLOVAKIA: Bohemia, Sobotka, on *Clivicola riparia*, II-9-1959, (3 females).

Haemogamasus pontiger (Berlese)
(Figs. 11 a-n)

Laelaps (Eulaelaps) pontiger Berlese, 1904: 260.

Eulaelaps pontiger (Berlese): Radford, 1950.

Eulaelaps mawsoni Womersley 1937: 19.

Haemogamasus oudemansi Hirst, 1914: 122; Allred, 1957: 34.

Euhaemogamasus oudemansi (Hirst): Keegan, 1951: 240.

Groschaftella pontiger (Berlese): Privora and Samsinak, 1957: 269.

Haemogamasus pontiger (Berlese): Evans and Till, 1966: 257.

DIAGNOSIS — A medium sized mite of the *reidi* group characterized in the female by the shape of the sternal shield which is posteriorly invaginated to a level midway between sternal setae I and II; and in the male by sparse setation on the holoventral shield and thin leg II which lacks stout ventral setae.

FEMALE—Described from five specimens. Mean measurements are followed by minimum and maximum in parentheses.

Cheliceral segment I III (108-116) μ long, segment II 168 (161-172) μ long. Movable digit (fig. 11 a) 54 (52-61) μ long with two large recurved teeth and ending in a single large tooth. Fixed digit with two teeth and ending in a single tooth. *Pilus dentilis* setiform, dorsal seta digitiform. A brush border at base of chelicera. Dorsal and lateral lyriform fissures distinct. Hypostomal setae I unbarbed, all other gnathosomal setae barbed. Capitular setae 84 (73-96) μ apart, hypostomal setae II 65 (64-67) μ apart. Deutosternal groove (fig. 11 b) slightly wider posteriorly with 11-13 transverse rows of denticles 2-7 per row. Corniculi 61 (58-64) μ long. Tectum (fig. 11 c) broadly triangular with long, mostly unbranched anterior fimbriae and few short posterior projections. Pedipalp with three-tined apotele; both trochanteral setae barbed; genu with *al*₁ thickened.

Dorsal shield 852 (816-876) μ long by 516 (420-564) μ wide, sparsely covered with setae, mostly of uniform length. "Setae *jl* considerably stouter than the others, with fine barbs" (Evans and Till, 1966), some anterior and lateral setae barbed. Two conspicuous pores on posterior margin of shield, one on either side of midline. Tritosternum base 55 (44-67) μ long, laciniae III (108-114) μ long. Presternal area with numerous small teeth on reticulations.

Sternal shield (fig . 11 d) 141 (139-146) μ long by 161 (157-175) μ wide anteriorly and 221 (201-244) μ wide posteriorly, without accessory setae. Sternal setae I barbed 99 (90-108) μ apart, sternal setae I and III 111 (108-117) μ apart. Posterior concavity extending anteriorly to a level between sternal setae I and II, 97 (93-105) μ long by 154 (145-175) μ wide. Genitoventral shield (fig . 11 e) flask shaped, 471 (407-490) μ long by 213 (193-230) μ wide at base, 13-21 accessory setae on posterior half of shield. Anal shield (fig . 11 f) 141 (140-146) μ long by 111 (108-121) μ wide with 0 (0-1) accessory setae. Paranal setae barbed 57 (52-61) μ long, postanal seta barbed 65 (52-70) μ long. Small oval metapodal shield posterior to coxa IV. Stigma between coxae III and IV, peritreme extending anteriorly to level of coxa II, 143 (140-149) μ long. Anterior tip of peritrematal shield appears free from dorsal shield, posterior portion fused to podal shields of coxa IV.

Most leg setae barbed; paired, ventral setae on legs II, III and IV stouter than other leg setae. Tarsus IV (fig . 11 g) with pd_2 long. Tarsal length/width as follows: Leg I 6. 2, Leg II 4. 9, Leg III 5. 6, and Leg IV 8. 7.

MALE —Based on five specimens, similar to females except as follows:

Cheliceral segment I 82 (79-87) μ long, segment II 134 (128-145) μ long. Movable digit (fig . 11 h) 47 (41-52) μ long, sharply bent toward fixed digit with a small spur on leading edge. Movable digit and spermadactyl together 61 (58-64) μ long with spermadactyl bent 90 degrees over digit. Fixed digit with one small medial tooth and setiform *pilus dentilis*. Capitular setae 76 (73-79) μ apart, hypostomal setae II 56 (52-61) μ apart. Deutosternal groove (Fig . 11 i) parallel sided with 12-16 transverse rows of denticles, 2-6 per row. Corniculi blunt 50 (47-58) μ long.

Dorsal shield 720 (708-744) μ long by 432 (396-444) μ wide. Tritosternum base 50 (44-55) μ long, laciniae 79 (73-87) μ long. Holoventral shield (figs. 11 k, l) 568 (553-591) μ long by 131 (127-139) μ wide at the level of genital opening and 329 (311-343) μ wide below level of coxae IV, extending laterally and anteriorly around coxa IV nearly to midcoxa. Shield with four pairs of sternal setae, genital setae distinct. Sternal setae I barbed 84 (79-90) μ apart, sternal setae I and III 102 (92-113) μ apart. Paranal setae 38 (35-41) μ long, postanal seta 41 (38-44) μ long. Sparse accessory setae on opisthogastric region of holoventral shield, extending below or to genital setae. Peritreme 134 (116-151) μ long. Peritrematal shield fused or unfused to holoventral shield.

Unthickened leg II (fig . 11 m) without stout ventral setae. Tarsal length/width as follows: Leg I 6. 7, Leg II 5. 4, Leg III 5. 8, and Leg IV 8. 5.

TYPES —*Haemogamasus pontiger* is in the Berlese Collection, Stazione di Entomologia Agraria at Florence, Italy and could not be obtained for this study.

DISTRIBUTION —This species has been recorded from Canada and the United States. It has also been collected at several U. S. sea and air ports from European agricultural goods.

SPECIMENS EXAMINED —CALIFORNIA: San Mateo Co., San Bruno, in *Neotoma fuscipes* nest, V-15-1957, (1 female UCB). GEORGIA: Grady Co., on *R. norvegicus*, III-23-1948, (4 females, same slide). ILLINOIS: at Chicago, from Germany on grass packings, II-13-1950, (4 females, same slide). NEW MEXICO: Santa Fe Co., in *Neotoma micropus* nest # 2, II-25-1952, (3 females and 6 males on two slides). NEW YORK at Buffalo, from Germany: in hay packing; XI-7-1950, (1 female, 3 deutonymphs, on same slide); in hay packing, XI-7-1950, (6 females TTU); on beet seed, VII-23-1949, (8 females and 1 male on same slide); from Finland with wheat, IX-6-1949, (4 females); from Scotland in sod in ballast, VIII-10-1944, (1 female TTU); PENNSYLVANIA: at Philadelphia, from Scotland, in old burlap bagging, I-16-1951, (1 female TTU). UTAH: Sevier Co., Koosharem Res. in *Tamiasciurus hudsonicus* nest VII-22-1953, (1 female, 1 male, 1 nymph on same slide UCB). WASHINGTON, D. C. at National Airport, from Azores: Santa Maria, on rye straw, VI-11-1946, (1 male). CANADA: Alberta, Peace River on grain spill,

(1 female OSU); Manitoba, Winnipeg, Stoney Mt. Pen., on oats, (1 male OSU); Newfoundland, Mt. Pearl, (1 female OSU). Also a slide marked "#676-51-1138 (2 females)".

Haemogamasus thomomysi Williams, n. sp.
(Figs. 12 a-n)

DIAGNOSIS — A medium sized species of the *reidi* group, the female having a very broad flask shaped genitoventral shield with no accessory setae anterior to the genital setae and the male with a thin spermadactyl twice the length of the movable digit.

FEMALE — Described from the holotype and three paratypes.

Cheliceral segment I 105 (90-105) μ long, segment II 151 (145-151) μ long. Movable digit 58 (55-61) μ long (fig. 12 a) with two recurved teeth, the proximal larger and the distal smaller, and ending in a single large tooth. Fixed digit with a proximal pointed ridge, two widely spaced distal teeth, and ending in a small tooth. *Pilus dentilis* long, swollen at base and curving at tip. Dorsal seta not visible on holotype or paratypes. Dorsal and lateral lyriform fissures distinct. All gnathosomal setae barbed. Capitular setae 79 (76-82) μ apart, hypostomal setae II 61 (58-64) μ apart. Deutosternal groove parallel sided (fig. 12 b) with 10 (10-11) transverse rows of denticles, 2-8 per row. Corniculi 47 (41-47) μ long. Tectum (fig. 12 c) triangular, deeply denticulate with many long, simple or forked, anterior fimbriae and many small posterior projections on each side. Pedipalp with two-tined apotele; both trochanteral setae barbed, genu with seta al_1 thickened.

Dorsal shield 924 (924-972) μ long by 564 (552-600) μ wide, covered with setae mostly of uniform length with few anterior and marginal setae barbed. Several inconspicuous pores scattered on shield and two large pores on posterior margin of shield, one on either side of midline. Tritosternum base 41 (41-49) μ long, laciniae 148 (125-148) μ long. Presternal area with numerous small teeth on reticulations. Sternal shield (fig. 12 d) 84 (84-93) μ long by 184 (177-201) μ wide anteriorly and 277 (254-277) μ wide posteriorly without accessory setae. Sternal setae I barbed 113 (108-113) μ apart, sternal setae I and III 102 (96-102) μ apart. Posterior concavity extending anteriorly to just past level of sternal setae III, 29 (20-32) μ long by 146 (131-146) μ wide. Genitoventral shield (fig. 12 e) very broad, flask shaped, 454 (437-481) μ long, including anterior flap, by 250 (228-277) μ wide at base with 79 (62-79) accessory setae on posterior two-thirds of shield, extending anteriorly to constriction of shield. Anal shield (fig. 12 f) 116 (113-125) μ long by 108 (96-108) μ wide with 1 (0-1) accessory seta. Paranal setae barbed 70 (55-70) μ long, postanal seta barbed, 58 (58-79) μ long. Small variable metapodal shield posterior to coxa IV. Stigma at anterior edge of coxa IV with peritreme extending anteriorly to mid coxa II, 236 (210-262) μ long. Anterior tip of peritrematal shield appears to fuse with dorsal shield, posterior part of shield fused to podal shields of coxa IV.

Most leg setae barbed. Tarsus IV with seta pd_2 long (fig. 12 g). Leg I claw reduced. Tarsal length/width as follows: Leg I 4. 6, Leg II 3. 9, Leg III 5, and Leg IV 7. 6.

MALE — Based on allotype and one paratype. Measurements for allotype followed by those of paratype in parentheses. Males similar to females except as follows:

Cheliceral segment I 105 (90) μ long, segment II 134 (131) μ long. Movable digit (fig. 12 h) 52 (49) μ long, with large spur on leading edge. Movable digit with spermadactyl together 96 (99) μ long. Digitiform spermadactyl extends anteriorly from exterior face of movable digit, its distal portion almost parallel to long axis of movable digit and extending past cheliceral digits by one length of movable digit. Fixed digit longer or equal in length to movable digit with long thin curved *pilus dentilis*. Dorsal seta not visible in specimens examined. Dorsal and lateral lyriform fissures distinct. All gnathosomal setae barbed. Capitular setae 73 (73) μ apart, hypostomal setae II 58 (58) μ apart. Deutosternum parallel sided (fig. 12 i) with 10 (11) rows of denticles, 2-7 per row. Corniculi blunt 38 (41) μ long.

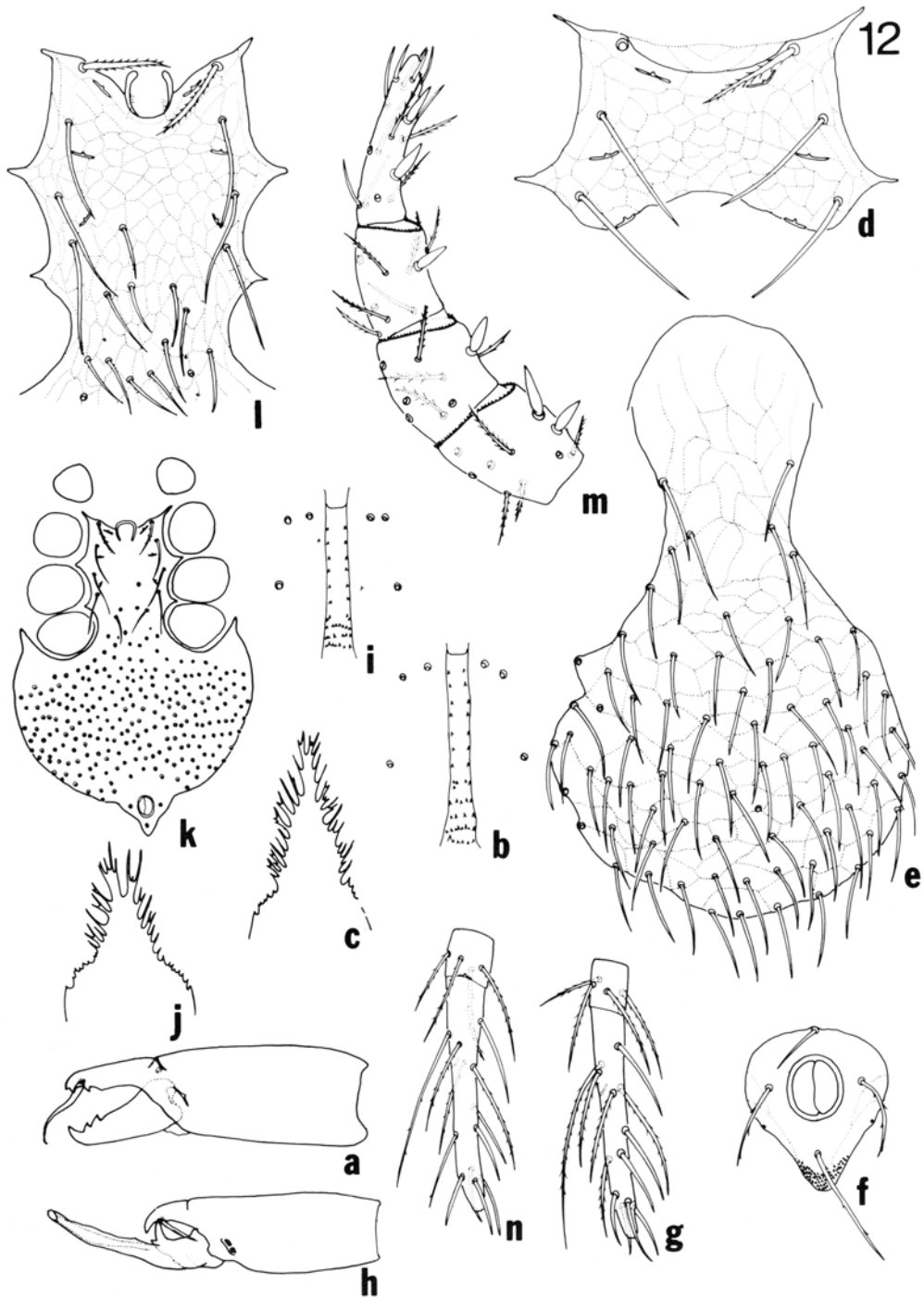


Fig. 12: *Haemogamasus thomomysi* Williams, n. sp., a-g female, h-n male: a, chelicera-lateral view; b, deutosternal groove; c, tectum; d, sternal shield; e, genitoventral shield; f, anal shield; g, tarsus IV-lateral view, dorsal surface on left; h, chelicera-lateral view; i, deutosternal groove; j, tectum; k, holoventral shield; l, sternal area of holoventral shield; m, leg II-ventral view, dorsal surface on left; n, tarsus IV-lateral view, dorsal surface on left.

Dorsal shield 840 (828) μ long by 492 (492) μ wide. Tritosternum base 41 (49) μ long, laciniae lost on allotype, (122) μ long. Presternal area with strong spines. Holoventral shield (figs. 12 k, l) 623 (594) μ long by 163 (148) μ wide at level of genital opening and 457 (431) μ wide below level of coxa IV, extending laterally around coxa and anteriorly to midcoxa. With four pairs of sternal setae, genital setae indistinct. Sternal setae I barbed, 102 (96) μ apart, sternal setae I and III 96 (90) μ apart. Paranal setae barbed, lost on allotype (58) μ long, postanal seta barbed 70 (67) μ long. Numerous setae distributed on opisthogastric region of holoventral shield, a few extend anteriorly to level between sternal setae III and IV. Peritreme 146 (160) μ long, extending to level of coxa II. Peritrematal shield partially fused to holoventral shield.

Thickened leg II (fig. 12 m) bears stout ventral setae as follows: Two on femur v_2 and v_3 , one on genu av , one on tibia av and two on tarsus mv and av_3 . Tarsal length/width as follows: Leg I 4. 3, Leg II 4. 4, Leg III 5. 6, and Leg IV 6. 7.

TYPES — The female holotype USNM No. 3753 along with a dissected, indicated, female paratype is on a slide marked "on *Thomomys* sp. Calif., Fresno Co., July 6, 1932 by B. P. Bole, Jr., Bish. #19728". The holotype is ringed in ink and labelled "holotype" on the left hand label.

The allotype male is on a slide marked "Calif. Fresno Co., in nest of *Thomomys monticola*, January 27, 1948 from L. G. Ingles v. 4 lot. 48-1665" and labelled "allotype" on the left label. Paratypes, three females and one male as follows: Same data as holotype (1 dissected female on slide with holotype); same data as allotype (2 females and 1 male on separate slides). All type material has been deposited in the USNM.

REMARKS — *Haemogamasus thomomysi* closely resembles *H. longitarsus* in the shape of the genitoventral shield but differs in having no accessory setae anterior to the genital setae and the male with a long thin straight spermadactyl while *H. longitarsus* possesses accessory setae to the flap of the genitoventral shield and a massive curved and twisted male spermadactyl.

DISTRIBUTION — Presently recorded from California and Utah; however, western collections marked "*H. longitarsus*, *H. microti* or *H. barberi*" should be re-examined as they will most likely represent this species.

ADDITIONAL SPECIMENS EXAMINED — UTAH: Utah Co., Summit, Aspen Grove, on *Clethrionomys g. galei*, VII-18-1952, F898 (1 female UCB).

ETYMOLOGY — *Haemogamasus thomomysi* is named for *Thomomys* on which it was first collected.

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