

A REVIEW OF THE *HOPLOPLEURA HESPEROMYDIS* COMPLEX (ANOPLURA, HOPLOPLEURIDAE)*

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ABSTRACT: The adults of the known species of the *Hoplopleura hesperomydis* complex are described and illustrated. Three new species: *H. difficilis*, *H. similis*, *H. cooki* and one new subspecies: *H. ferrisi amphirecia* are described. *H. reithrodontomydis* Ferris is resurrected on the basis of immature and adult stages, and the first and second nymphs are described in addition to the description of the adult. The characters of taxonomic importance and the history of the group are discussed. A key to adult stages of the known species of the complex is presented.

The louse species, *Hoplopleura ferrisi* Cook and Beer, was originally described on the basis of characters found solely in the immature stages by Cook and Beer (1959). The adult stage of *H. ferrisi*, which was assumed to be identical with that of *H. hesperomydis* (Osborn) at the time of description, has usually been mistakenly identified as *H. hesperomydis*.

In the adult stage *H. hesperomydis* is, however, distinctly differentiated from *H. ferrisi* by a quantitative analysis or discriminant function (Kim, Brown, and Cook, 1965). At the same time a *posteriori* investigation of the taxonomic characters of the adults revealed some good discriminatory adult characters for *H. ferrisi* and *H. hesperomydis*.

Upon studying the problem I have discovered that there are several new taxa in this *Hoplopleura hesperomydis* complex. All of the species or taxa, except for *H. reithrodontomydis* Ferris, will key to *H. hesperomydis* in Ferris' monograph (1951).

The scientific names of the host species are those of Ellerman (1940-1949), and Hall and Nelson (1959).

The complex is distinguished from all other louse species by the following combination of characters. Antennae clearly 5-segmented. Sternal plate of 2nd abdominal segment and usually of 3rd abdominal segment extended laterally to articulate with corresponding paratergites; these two plates always narrow and transverse. First sternal plate of 3rd abdominal segment also laterally extended to approximate and articulate with corresponding paratergites. Enlarged setae of first sternal plate of 3rd

abdominal segment arranged in two groups of 2 setae. Paratergites of abdominal segments 3 to 6 with posterior margin divided into two apically truncate or slightly emarginate lobes. Paratergites of abdominal segments 4 to 6 with posterior setae either much shorter than the depth of the median emargination or completely lacking. Dorsal and ventral lobes of paratergal plate of abdominal segment 7 apically acute. Paratergites of abdominal segment 8 entirely devoid of any apical processes.

In this paper three new species and one new subspecies of the complex are described with notes on the other species. The adult characters of taxonomic importance are also discussed. *H. reithrodontomydis* Ferris is resurrected on the basis of immature and adult stages. The complex therefore contains eight species and one subspecies, distinguished on several characters, even though general morphology is very much alike.

HISTORICAL

Since Osborn (1891) first described *Hoplopleura hesperomydis*, from the white-footed mouse, *Peromyscus leucopus* (Rafinesque), at Ames, Iowa, this species has been recorded from many other species of hosts. In Ferris' monograph (1921) it was recorded from *Peromyscus leucopus* (Rafinesque), *P. maniculatus* (Wagner), *P. boylii* (Baird), *Mus musculus* Linn. (= *Mus gansus*, Taochou, Kansu, China; *Mus wagneri mongolium*, Tai-yuan-fu, Shansi, China, *vide* Ferris, 1951), *Onychomys torridus* (Coues), *O. leucogaster* Wied., *Hesperomys callosus* (Rengger) (Ferris, 1921; Hopkins, 1949), *Oryzomys chaparensis* Osgood, and *Oryzomys fulvescens* (Saussure).

Ferris (1951) described *H. reithrodontomydis* from *Reithrodontomys* spp., and then in 1953 sank this species on the ground that all degrees of intergradations occur in the characters of the apical lobes of the paratergites of the 7th abdominal segment, making a specific distinction untenable.

Received for publication 15 February 1965.

*Paper No. 5622 Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota 55101.

Since Ferris' monumental work, "The Sucking Lice" (1951), was published, the species of *Hoplopleura* including immature stages have been extensively studied by several workers (Pratt and Lane, 1951; Stojanovich and Pratt, 1961).

Cook and Beer (1959) studied the immature stages of North American species of *Hoplopleura*, and described two new species of the complex, *H. ferrisi* from *Peromyscus boylii* (Baird), *P. nasutus* (J. A. Allen), and *P. eremicus* (Baird), and *H. onychomydis* from *Onychomys torridus* (Coues). This has left *H. hesperomydis* restricted to *P. maniculatus*, *P. leucopus*, *Mus musculus*, *Onychomys leucogaster*, *Hesperomys callosus*, *Oryzomys chaparensis* and *O. fulvescens*.

Johnson (1960) described another species of the complex, *H. captiosa* from *Mus musculus*, Africa and USA; *Mus cervicolor*, Thailand; *M. bacterianus* and *M. caroli*, Ryukyu, Japan; as well as *Thos* sp., Africa (a predator of *Mus* spp.). Wegner (1961) published a description of a new species, *H. muscull*, from *Mus musculus* in Poland without reference to Johnson's work. *H. muscull* Wegner is apparently a synonym of *H. captiosa* Johnson.

ADULT CHARACTERS OF TAXONOMIC IMPORTANCE

In the taxonomy of *Hoplopleura* several external characters, such as the paratergal plates of the abdominal segments, the number of setae in the sternal plate of the 3rd abdominal segment and the thoracic sternal plate, have been consistently used. Additional characters of taxonomic importance for recognizing species have been found in this study.

Head

The setal arrangement of the head of *Hoplopleura* is rather consistent within a given species. The position, length, thickness, and arrangement of the head setae have not been used in the past except for immature stages (Cook and Beer, 1959). However, in this study the head setae are frequently used. For descriptive purposes the following names and abbreviations for the head setae will be used (Fig. 1).

Clypeal setae (CS); Oral setae (OS); Preantennal setae (PAS); Antennal setae (AS); Inner sutural head setae (ISHS); Outer sutural head setae (OSHS); Anterior marginal head setae (AMHS); Middle marginal head setae (MMHS); Posterior marginal head setae (PMHS); Principal dorsal head setae (PDHS); Posterior central head setae (PCHS); Accessory dorsal head setae (ADHS).

Thorax

The thoracic sternal plate is a single median plate located between the three pairs of coxae.

As shown in Figure 6, the anterior portion of the sternal plate is obovate with a posterior process. The posterior process of the sternal plate is tapered and pointed, rounded, or truncate at the end. The posterior process of the plate is of taxonomic importance.

Abdomen

The abdomen consists of nine distinct segments with the 10th segment being membranous, if present. Paratergal plates are present on eight segments and five paratergites of abdominal segments 3 to 7 bear spiracles. The gonopore is borne on the venter of 8th abdominal segment.

The sternal plates of the 2nd, and usually the 1st and 3rd abdominal segments are extended laterally to articulate with the corresponding paratergites. The first sternal plate of the 3rd abdominal segment bears two groups of 2 or 3 enlarged, stout setae.

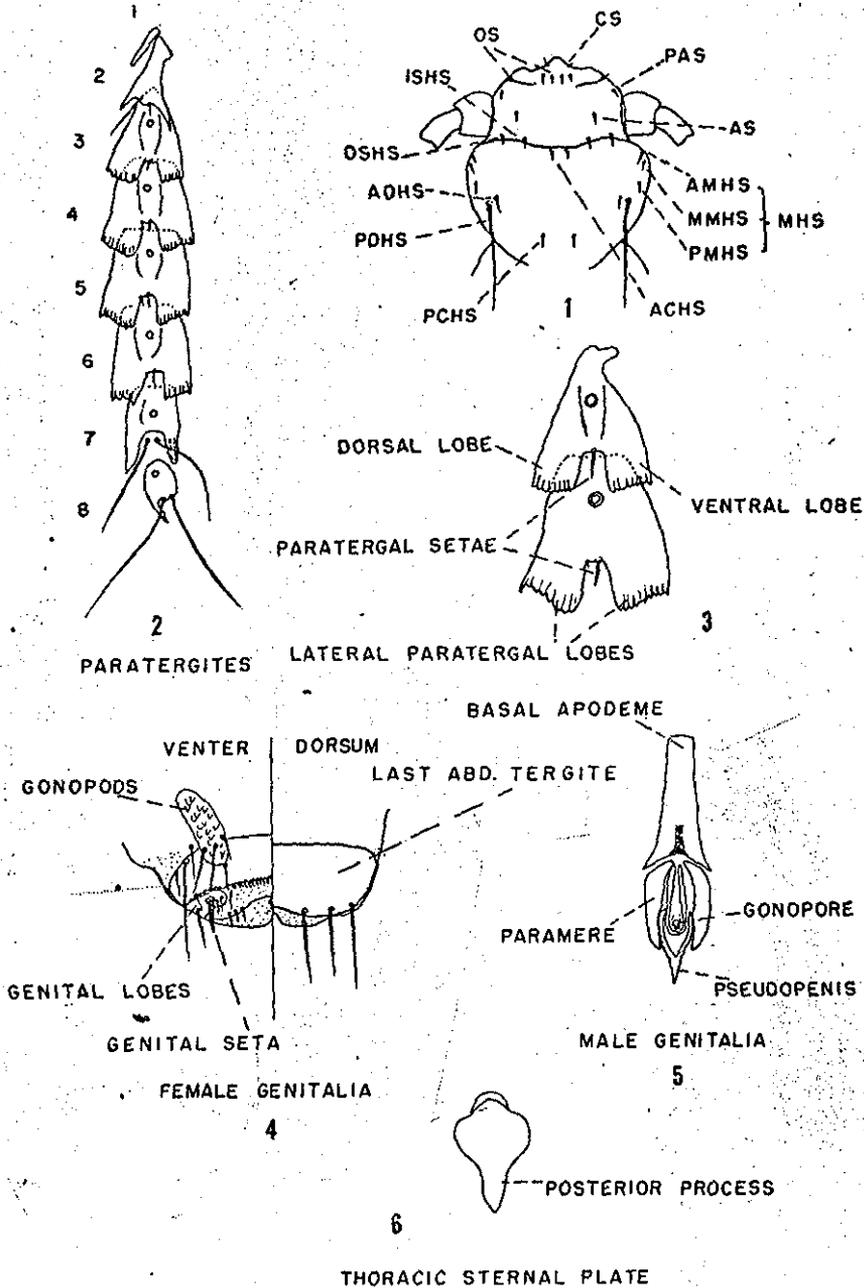
The paratergal plates or paratergites are distinct, sclerotized plates found at the lateral margin of eight of its abdominal segments. The first paratergite is a small, rodlike sclerite without setae. The second and third paratergites are more or less triangular with a narrow and elongate anterior process (Fig. 2). The posterior part of the paratergite forms two distinctly acute lobes.

The paratergites of abdominal segments 4 to 6 are rectangular with a rather deep median emargination (Figs. 2, 3). The depth of the median emargination varies according to the species. The lateral lobes of the paratergites are formed by this emargination. These lobes are referred to as the dorsal and ventral lobes or, collectively, the lateral paratergal lobes. In many species the lateral paratergal lobes may be secondarily divided into two distinct lobules (Fig. 51). These lobules vary in size in different species.

The paratergal plates generally bear 2 setae, one dorsal and one ventral, on the median posterior margin of the plate (Figs. 2, 3). These are referred to as the paratergal or apical setae. The paratergites of abdominal segments 7 and 8 may or may not possess lateral paratergal lobes, but always have a pair of long setae.

The form of the plates, the size and number of paratergal setae, the size and number of the lateral paratergal lobes are of great taxonomic importance.

H. COOKI SP. NOV.



FIGURES 1-6. *Hoplopleura cooki* sp. n. 1. Dorsal view of head (setal arrangement). CS, clypeal setae; OS, oral setae; PAS, preantennal setae; AS, antennal setae; ISHS, inner sutural head setae; OSHS, outer sutural head setae; ACHS, anterior central head setae; MHS, marginal head setae; AMHS, anterior marginal head setae; MMHS, middle marginal head setae; PMHS, posterior marginal head setae; PDHS, posterior dorsal head setae; PCHS, posterior central head setae; ADHS, accessory dorsal head setae. 2. Paratergites of abdominal segments 1-8. 3. Paratergites of third and fourth abdominal segments. 4. Female genitalia. 5. Male genitalia. 6. Thoracic sternal plate, female.

There is some sexual dimorphism in the shape of the plate and the number of setae on the paratergites in some species.

Male genitalia

The male genitalia consist of three major parts: a basal apodeme, paramere, and pseudopenis (Fig. 5). The basal apodeme is a long, rodlike sclerite. The length and thickness of the basal apodemes is specifically distinct.

The parameres are paired elongate sclerites which articulate anteriorly to the posterior end of the basal apodeme. The shape, length and thickness of the paramere are also of taxonomic importance.

The pseudopenis is a Y-shaped sclerite between the parameres. The side of each arm of the pseudopenis is variously serrate. The gonopore lies between the two anterior arms of the pseudopenis.

Female genitalia

The principal parts of the female genitalia are: the genital plate, gonopods, and genital lobes.

The genital plate is the sternal plate of abdominal segment 8 and sometimes involves also the venter of segment 7. It is variously shaped and bears several inconsistent setae. The pigmentation of the genital plate usually becomes indistinct in the process of slide preparation so that the plate is difficult to define.

The gonopods are paired, sclerotized, flattened lobes or plates. The gonopods can be identified by the presence of an apical cluster of 3 rather strong setae on each side.

The sternum of abdominal segment 9 bears near each lateral margin a distinct lobe bearing a tuft of setae. These are here called genital lobes. An enlarged seta on the genital lobe is called the genital seta. The genital setae are sometimes flattened and spiniform (Fig. 4).

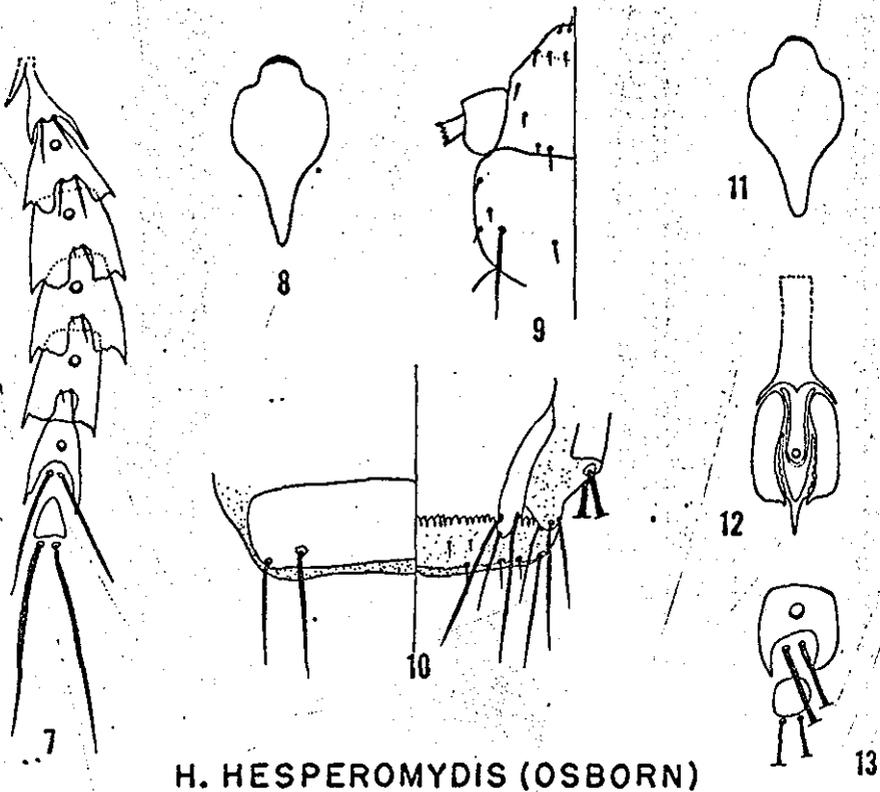
LIST OF SPECIES OF THE HESPEROMYDIS GROUP AND THEIR HOSTS

Species	Host
1. <i>H. hesperomydis</i> (Osborn)	<i>Peromyscus leucopus</i> (Rafinesque) white-footed mouse, N. Amer. <i>P. maniculatus</i> (Wagner) deer mouse, N. Amer. <i>P. gossypinus</i> (Le Conte) cotton mouse, N. Amer.
2. <i>H. difficilis</i> sp. n.	<i>P. crinitus</i> (Merriam) canyon mouse, N. Amer.
3. <i>H. reithrodontomydis</i> Ferris	<i>Reithrodontomys megalitis</i> (Baird) western harvest mouse, N. Amer. <i>R. sumichrasti dorsalis</i> Merriam sumichrasti harvest mouse, C. Amer. <i>R. sumichrasti australis</i> , J. A. Allen sumichrasti harvest mouse, C. Amer. <i>R. chrysoptis</i> Merriam volcano harvest mouse, Mexico
4. <i>H. onychomydis</i> Cook and Beer	<i>Onychomys torridus</i> (Coues) southern grasshopper mouse, N. Amer. <i>Onychomys leucogaster</i> (Wied-Neuwied) northern grasshopper mouse, N. Amer.
5. <i>H. ferrisi ferrisi</i> Cook and Beer	<i>Peromyscus boylii</i> (Baird) brush mouse, N. Amer. <i>P. nasutus</i> (J. A. Allen) rock mouse, N. Amer. <i>P. eremicus</i> (Baird) cactus mouse, N. Amer.
6. <i>H. ferrisi emphereta</i> subsp. n.	<i>Peromyscus nudipes</i> (J. A. Allen) naked-footed deer mouse, C. Amer. <i>P. guatemalensis</i> Merriam Guatemalan deer mouse, C. Amer. <i>P. mexicanus</i> (Saussure) Mexican deer mouse, C. Amer.
7. <i>H. captiosa</i> Johnson	<i>Mus musculus</i> Linn. house mouse, world-wide <i>Mus cervicolor</i> (Hodgson) Thailand <i>Mus bacterianus</i> (Blyth) (= subsp. of <i>Mus musculus</i>), Ryukyu, Japan

P. californicus (Gambel)
California mouse, N. Amer.

P. truei (Shufeldt)
piñon mouse, N. Amer.

P. nuttalli (Harlan)
golden mouse, N. Amer.



H. HESPEROMYDIS (OSBORN)

FIGURES 7-13. *Hoplopleura hesperomydis* (Osborn). 7. Paratergites of abdominal segments 1-5. 8. Thoracic sternal plate, female. 9. Dorsal view of head. 10. Female genitalia. 11. Thoracic sternal plate, male. 12. Male genitalia. 13. Paratergites of seventh and eighth abdominal segments.

Polyplax ? *hesperomydis* (Osborn), Enderlein, 1904, p. 143; Dalla Torre, 1908, p. 14.

Hoplopleura hesperomydis (Osborn), Kellogg and Ferris, 1915, p. 17, textfig. 4-5, pl. 1, fig. 3; pl. 4, fig. 1; pl. 5, fig. 14; Johnson, 1958, p. 41; Cook and Beer, 1959, p. 408-409, figs. 6, 11.

Hoplopleura hesperomydis (Osborn) (*partim*), Ferris, 1916b, "Cat. Anop.," p. 155 (not the records from *Peromyscus boylii* and *Mus musculus*); Ferris, 1916a, p. 112 (not the records from *Onychomys* and *Oryzomys*); Ferris, 1921, p. 70-71 (not the records from *Peromyscus boylii*, *Onychomys*, *Mus*, *Oryzomys*, and *Hesperomys*); Hopkins, 1949, p. 470 (not the records from *Oryzomys*, *Onychomys*, *Hesperomys*, *Mus*, *Peromyscus boylii*); Ferris, 1951, p. 136-137 (not the records from the hosts listed in 1921); Morlan and Hoff, 1957, p. 348-349 (not the records from *Peromyscus boylii*, *P. nasutus*, *Onychomys*, and probably *Microtus*).

Type data

Lectotype male; 2 males and 1 female from *Peromyscus leucopus* at Ames, Iowa. The lectotype

was designated from a series of 4 syntypes on one slide by Johnson (1958). The type material is deposited in the collection of U. S. National Museum.

H. hesperomydis (Osborn) was originally described from 3 males and 1 female found on the white-footed or deer mouse, *Peromyscus leucopus* (Osborn, 1891 called it *Hesperomys leucopus*) at Ames, Iowa. Since Ferris (1916) the species recorded as *H. hesperomydis* from various hosts other than *Peromyscus leucopus* and *P. maniculatus* are probably not *H. hesperomydis* s. str. The specimens from *Oryzomys chaparensis* and *O. fulvicens*, South America, reported as *H. hesperomydis* are referred to a new species, *H. similis*, described in this paper. Those from *Hesperomys callowii*, Argentina, are referred to *H. cooki* sp. n.

Diagnosis

Total body length: female about 1.15 mm, male about 0.77 mm. Related to *H. difficilis* sp. n., *H. ferrisi* Cook and Beer, *H. reithrodontomydis* Ferris and *H. onychomydis* Cook and Beer. Very close to *H. difficilis*. Female separable from *difficilis* in having dorsal paratergal setae of abdominal segments 3 to 6 short, but not minute. Male differ-

from *reithrodontomydis* by having both paratergal setae of 2nd and 3rd abdominal segments similar in size and paramere of uniform thickness. Separable from *ferrisi* in having MMHS placed closer to PPHS and lateral paratergal lobes of 4th and 5th abdominal segments with acute lateral lobules. Also separable from *onychomydis* in having thoracic sternal plate with posterior process pointed, paratergal setae of abdominal segments 4 to 6 shorter than the depth of median emargination, and paramere of uniform thickness. The genital setae of female are not spiniform. The posterior process of male thoracic sternal plate is less acute.

New records

From *Peromyscus californicus californicus* (Gambel): CALIFORNIA: Pasadena, 15 Mar. 1933, I. C. Barr, 1 female. Ex *P. c. insignis* Rhoads: CALIFORNIA: San Simeon, date unknown, R. L. Boker, 2 female; Los Angeles Co., 11 Jan. 1933, 12 males and 1 female. Ex *P. truei* (Shufeldt): UTAH: Tooele Co., 13 Aug. 1953, E. A. Shippee, 1 male and 3 females. Ex *P. gossypinus* (Le Conte): ALABAMA: Dale Co., 5 Apr. 1937, R. E. Dyer, 3 males and 8 females; 18 May 1937, R. E. Dyer, 1 male and 1 female; FLORIDA: Tallahassee, 1 Sept. 1946, B. V. Travis, 3 nymphs; GEORGIA: Ware Co., 27 Apr. 1933, F. Harper, 1 male and 1 female; 2 miles W of Folkston, 23 Feb. 1936, 1 male and 2 females; MISSISSIPPI: Handsboro, 14 Feb. 1940, G. C. Rohwer, 2 females; SOUTH CAROLINA: Awendow, Bull's Island, 21–22 Mar. 1939, W. P. Baldwin, 2 males and 5 females; 13–14 Jan. 1943, C. N. Smith, 3 males and 7 females. Ex *P. nuttalli* (Harlan): ALABAMA: Dale Co., 5 Apr. 1937, R. E. Dyer, 3 females.

Specimens examined

Thirty-six collections from *Peromyscus leucopus*. Ex *P. leucopus*: MARYLAND: Montgomery Co., 1 male and 1 female; College Park, 4 females; Laurel, 1 male; Riverdale, 4 males and 8 females; Mechanicville, 6 males and 8 females; MINNESOTA: Cedar Creek Forest, 1 male, 14 females and 56 nymphs; NEBRASKA: Richardson Co., Rulo, 4 females; NEW HAMPSHIRE: Pinkham Notch, 1 female; NEW JERSEY: Moorestown, 1 female; Northfield, 1 female; NEW MEXICO: Wilna, 1 nymph; OHIO: Gates Mills, 1 male; VIRGINIA: Falls Church, 1 female. Ex *P. leucopus noveboracensis* (Fisher): CONNECTICUT: New Haven, 3 males and 3 females; KANSAS: Ft. Leavenworth, 4 males and 5 females; MASSACHUSETTS: Fall River, 1 male and 3 females; MICHIGAN: East Lansing, 1 male and 2 females; NEW YORK: Cayuga Co., 2 males and 1 female; Rensselaerville, 1 male and 1 female; Shenandoah, 1 female; VIRGINIA: Falls Church, 8 females; WASHINGTON, D. C., 3 males and 3 females. Ex *P. l. leucopus* (Rafinesque): VIRGINIA: Disual Swamp, 10 females. Ex *P. l. fusus* Bangs: CONNECTICUT: Gay Head, 2 females. Fifty-one collections from *Peromyscus maniculatus* (Wagner). Ex *P. maniculatus*: MINNESOTA: Rosemount, 4 males, 4 females and 31 nymphs; Basswood Lake,

4 males, 6 females and 6 nymphs; OREGON: Harney Co., 3 males and 8 females; UTAH: Logan, 1 male and 5 females; Tooele Co., 20 males and 61 females; WASHINGTON: Kid Valley, 3 males and 4 females; WYOMING: Douglas, 2 nymphs; Fort Lewis, 3 males and 3 females. Ex *P. maniculatus abietorum* Bangs: MAINE: Mt. Katahdin, Basin Pond, 2 females. Ex *P. m. artemesia* (Rhoads): BRITISH COLUMBIA: Kamloops, 1 female. Ex *P. l. bairdi* (Hoy and Kennicott): OHIO: Columbus, 1 female. Ex *P. l. gambeli* (Baird): WASHINGTON: Moses Lake, 1 female. Ex *P. l. gracilis* (Le Conte): MINNESOTA: Lake Co., Basswood Lake, 13 males, 16 females, and 56 nymphs; NEW HAMPSHIRE: 3 miles NW Ossipee, 3 females; NEW YORK: Mt. Marcy, 1 female; Rensselaerville, 2 males and 1 female; PENNSYLVANIA: Wayne Co., 1 female; VERMONT: Morgan, 4 females. Ex *P. l. nebrascensis* (Coeus): WYOMING: Douglas, 8 males and 12 females. Ex *P. l. rubidus* Osgood: OREGON: Beverly Beach, 12 males, 15 females and 73 nymphs. Ex *P. l. rufinus* (Merriam): ARIZONA: Valle, 2 females and 1 nymph. Ex *P. l. sonoriensis* (Le Conte): CALIFORNIA: Fresno Co., Tully's Hole, 1 male. The data on the specimens from *Peromyscus californicus*, *P. truei*, *P. gossypinus*, and *P. nuttalli* are as in "New records."

Comments

There are specimens recovered from *Mus*, *Zapus*, *Perognathus*, and ? *Peromyscus nasutus*. They are either stragglers or contaminants.

2. *Hoplopleura difficilis* sp. n.

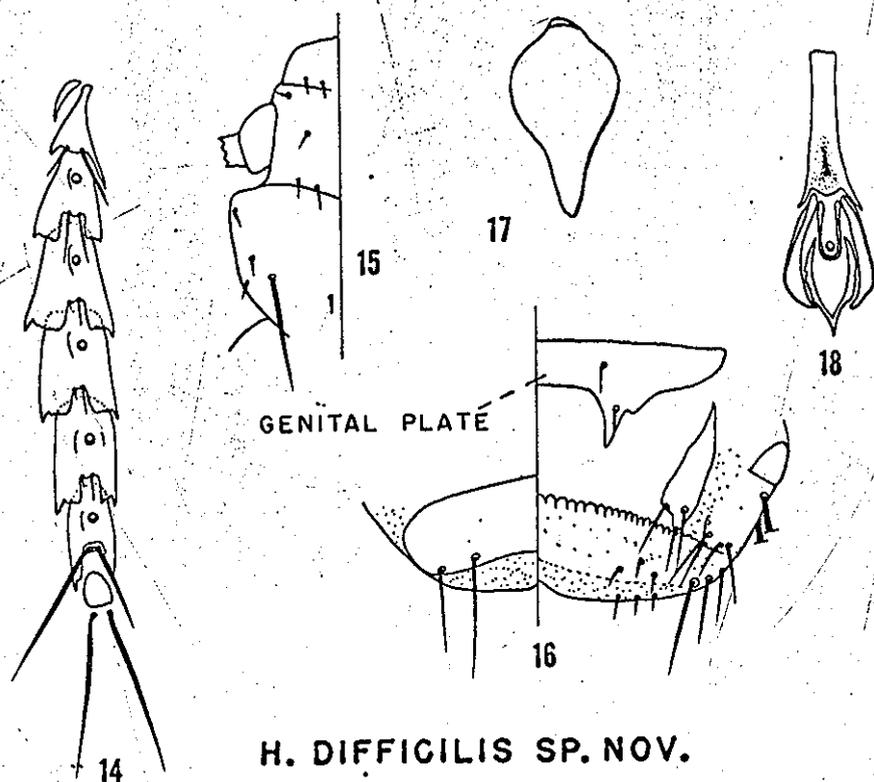
(Figs. 14–18)

Type data

Holotype female and allotype male (on one slide) from *Peromyscus crinitus* (Merriam), Tooele Co., Utah, 20 March 1953, collected by E. A. Shippee. Paratypes: 6 males and 5 females from *P. crinitus*, Tooele Co., Utah, 20 March to 13 April 1953, collected by E. A. Shippee; 2 females from *P. crinitus*, 19 November 1952, by J. P. Newey. Holotype, allotype, and 12 paratypes are deposited in the collection of U. S. National Museum. Two paratypes (1 male and 1 female on one slide) are deposited in the University of Minnesota Entomology Collection.

Diagnosis

Close to *H. hesperomydis* (Osborn), *H. reithrodontomydis* Ferris and *H. onychomydis* Cook and Beer. Females separable from *hesperomydis* in having dorsal paratergal setae of abdominal segments 4 to 6 minute, and differing from *reithrodontomydis* and *onychomydis* by having thoracic sternal plate with posterior process bluntly pointed. Males separable from *hesperomydis* and *reithrodontomydis* in having dorsal paratergal setae of 2nd and 3rd abdominal segments shorter than ventral setae, and differing from *hesperomydis*, *reithrodontomydis* and *onychomydis* by having paramere apically thickened.



H. DIFFICILIS SP. NOV.

FIGURES 14-18. *Hoplopleura difficilis* sp. n. 14. Paratergites of abdominal segments 1-8. 15. Dorsal view of head. 16. Female genitalia. 17. Thoracic sternal plate, female. 18. Male genitalia.

Description

Female: Total body length about 1.20 mm. **Head** (Fig. 15) broad behind antennae. MHS not arranged in a straight line; MMHS close to PDHS. Antennae 5-segmented; scape much wider than long and as long as pedicel. **Thorax:** sternal plate with posterior process bluntly pointed as in Figure 17. **Legs** as in other member of genus. **Abdomen:** sternal plate of 2nd segment with 2 groups of 4 setae extending laterally and articulating with paratergal plate. Anterior sternal plate of 3rd segment articulating laterally with corresponding paratergal plate, bearing the usual 2 groups of 2 enlarged setae. Ventral paratergal process of 2nd segment elongated and acute, bearing paratergal setae similar in size (Fig. 14). Paratergal setae of 3rd segment longer than depth of median emargination and similar in size. Dorsal paratergal setae of segments 4 to 6 minute. Lateral paratergal lobes of 7th segment distinct and pointed. Paratergite of 8th segment without lateral lobe. Seventh and 8th segments with pair of long paratergal setae. Last tergite with 2 setae on each side. **Genitalia** as in Figure 16; genital setae unspecialized.

Male: Total body length about 0.97 mm. **Head, thorax, and legs** as in female. **Abdomen** as in female with usual sexual differences. **Genitalia**

as in Fig. 18; paramere more or less thickened apically.

3. *Hoplopleura reithrodontomydis* Ferris

(Figs. 19-26)

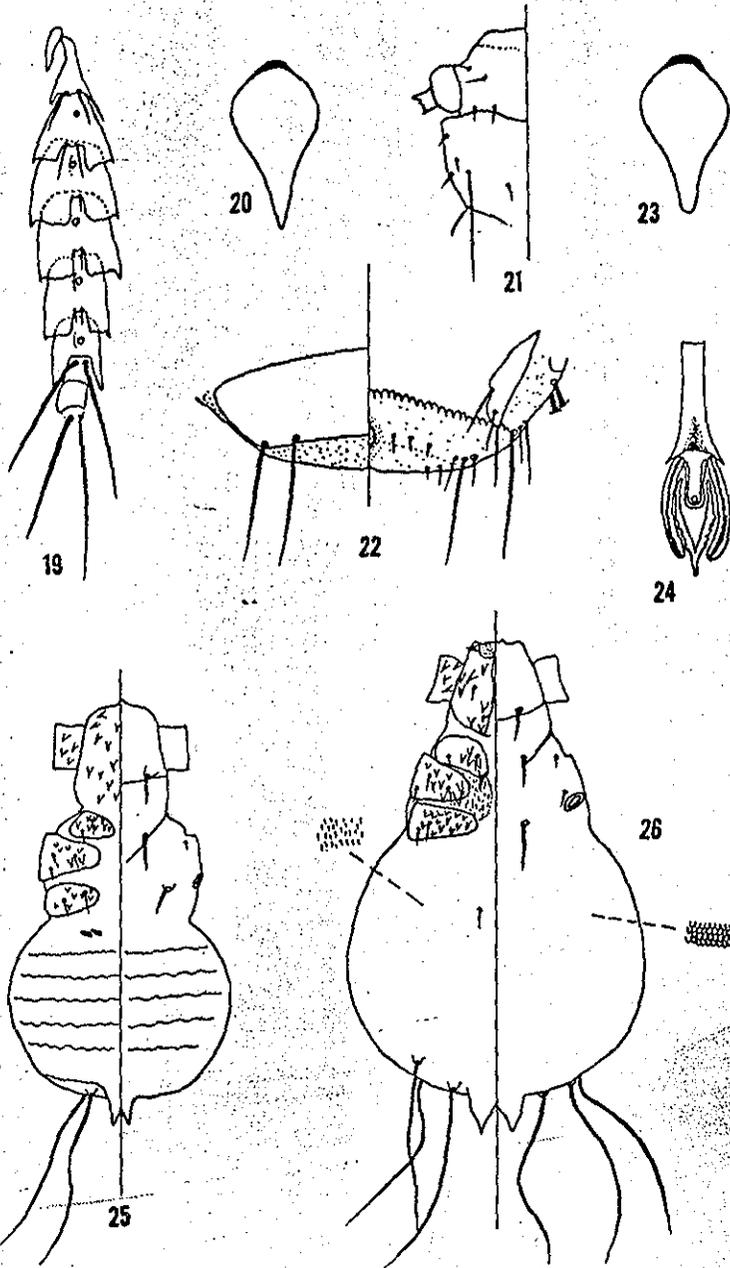
Hoplopleura reithrodontomydis Ferris, 1951, "The Sucking Lice," Mem. Pac. Coast Ent. Soc. 1: 143.

Hoplopleura hesperomydis (Osborn), Ferris, 1953, p. 52.

Type data

Dr. Robert L. Langston of the University of California, Berkeley, kindly sent me 14 slides containing 8 males and 23 females of *Hoplopleura reithrodontomydis* Ferris. Of 14 slides 3 from *Reithrodontomys dorsalis* Merriam, *R. australis* Allen and *R. chrysopsis* Merriam bear Ferris' handwritten label "*Hoplopleura reithrodontomydis* n. sp., holotype." One slide containing 1 male and 1 female specimens from *R. chrysopsis* bear "allotype" on the label in addition to "holotype." The other 11 slides bear Ferris' handwritten label "*Hoplopleura reithrodontomydis* n. sp." From 5 syntypes I here designate the lectotype. Lectotype, female from *Reithrodontomys dorsalis* Merriam.

H. REITHRODONTOMYDIS FERRIS



FIGURES 19-26. *Hoplopleura reithrodontomydis* Ferris. 19. Paratergites of abdominal segments 1-8. 20. Thoracic sternal plate, female. 21. Dorsal view of head. 22. Female genitalia. 23. Thoracic sternal plate, male. 24. Male genitalia. 25. Nymph 1, dorsal (right) and ventral (left) views. 26. Nymph 2, dorsal (right) and ventral (left).

Todos Santos, Guatemala, Ferris Collection 925 (USNM 76917). Paralectotypes: 8 males and 22 females; 3 males and 8 females from *R. dorsalis*, Todos Santos, Guatemala, Ferris Collection 925; 4 males and 9 females from *R. australis*, Volcan de Irazu, Costa Rica, Ferris Collection 926; 1 male and 5 females from *R. chrysopsis*, Ajusco near Mexico City, Mexico, Ferris Collection 923. The type specimens are deposited in the collection of the University of California at Berkeley, except for 2 paralectotypes on one slide which is in the University of Minnesota Entomology Collection.

Diagnosis

Very close to *H. hesperomydis* (Osborn), *H. difficilis* sp. n. and *H. onychomydis* Cook and Beer. Separable from *onychomydis* in having thoracic sternal plate with posterior process pointed and paratergal setae of abdominal segments 4 to 6 shorter than the depth of median emargination. Females differing from *hesperomydis* and *difficilis* by having thoracic sternal plate with posterior process acute. Further separable from *hesperomydis* and *difficilis* in having paratergite of 8th abdominal segment more or less rectangular in shape and dorsal paratergal seta of abdominal segments 4 to 6 minute. In the males *reithrodontomydis* differs from *difficilis* in having paramere of uniform thickness. This species is best identified in immature stages.

Description

Female: Total body length about 1.12 mm. **Head** (Fig. 21) and **thorax** very similar to those of *difficilis* and *hesperomydis* except posterior process of thoracic sternal plate acute or elongated and acute as in Figure 20. **Legs** as in other member of the genus. **Abdomen:** sternal plate of 2nd segment and anterior sternal plate of 3rd segment as in other member of the genus. Paratergal setae of 3rd segment longer than the depth of median emargination (Fig. 19). Dorsal paratergal setae of segments 4 to 6 minute. Paratergite of 7th segment with distinct lateral lobes on each side bearing a pair of long paratergal setae. Paratergite of 8th segment without lateral lobe and more or less rectangular in shape. Last tergite with 2 setae on each side. **Genitalia** as in Fig. 22; genital setae unmodified.

Male: Total body length about 0.80 mm. **Head**, **legs**, and **abdomen** as in female with usual sexual differences. Posterior process of thoracic sternal plate bluntly pointed. **Genitalia** as in Fig. 24; paramere of uniform thickness, lateral arms of pseudopenis with 2 prominent and 2 to 3 minute teeth.

Nymph 1 (Fig. 25): Total body length about 0.35 mm. Similar to nymph 1 of *H. ferrisi* and *H. onychomydis*. It differs from *ferrisi* and *onychomydis* in having no ventral abdominal setae and no minute setae near major abdominal setae, and is also separable from *onychomydis* in having prolonged anal segment. **Head** with anterior and posterior principal head setae of same size; ventral head tubercles strong and sharp; no other minute

dorsal head setae. **Thorax** with principal thoracic setae and 1 minute dorsal seta on mesothorax on each side; coxal tubercles strong and sharp. **Abdomen** clearly segmented; with no minute abdominal setae; 2 pairs of major abdominal setae; anal segment prolonged (Fig. 25); no paratergite or spiracles.

Nymph 2 (Fig. 26): Total body length about 0.56 mm. Similar to nymph 1 with some modifications. **Thorax** with an additional minute dorsal seta in front of the spiracle. Ventral tubercles of head and thorax larger and stronger. Abdomen with no trace of segmentation and 1 pair of minute ventral setae; 3 pairs of major abdominal setae, anal segment prolonged; no other minute setae; cuticle of abdomen appearing scaly and covered with microtrichia.

Nymph 3: Unknown.

Specimens examined

Thirty-one syntypes; data shown in "Type data." Ex *Reithrodontomys megalotis* (Baird): UTAH: Tooele Co., collected by E. A. Shippee, 3 males and 4 females. From *Reithrodontomys* sp., PANAMA: Chiriqui, Lava Flow, El. Hato 5,000 ft, 7 Jan. 1961, collected by Tipton, 8 nymphs.

4. *Hoplopleura onychomydis* Cook and Beer (Figs. 27-30)

Hoplopleura onychomydis Cook and Beer, 1959, J. Parasit. 45: 407-408, figs. 1-4, 7, 17.

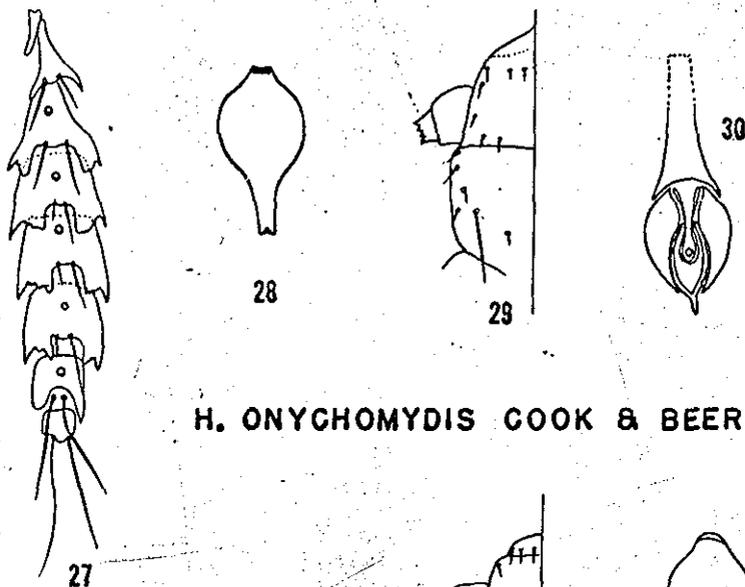
Hoplopleura hesperomydis (Osborn) (*partim*), Ferris, 1916a, p. 112 (*err. det.*, the records from *Onychomys torridus pulcher* and *O. leucogaster arctipes*); Ferris, 1921, p. 70-71 (*err. det.*, the records from *Onychomys*); Hopkins, 1949, p. 471 (the records from *Onychomys*); Ferris, 1951, p. 136-137 (the records from *Onychomys*); Morlan and Hoff, 1957, p. 349 (*err. det.*, the records from *Onychomys*).

Type data

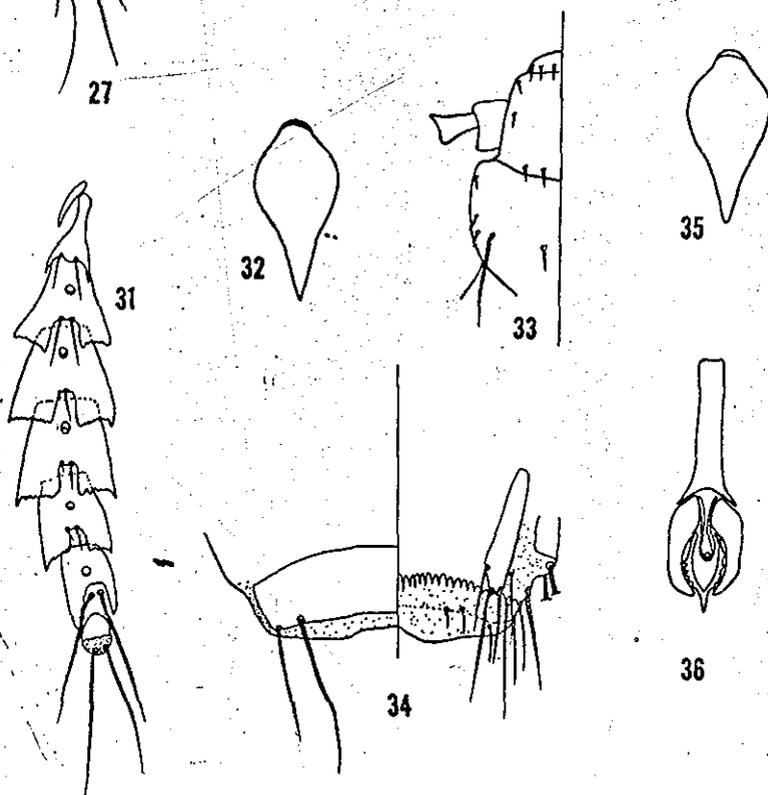
Holotype: a female from *Onychomys torridus* (Coues), Portal, Arizona, 3 August 1957, collected by James R. Beer and Robert Schwab. Allotype and paratypes from *O. torridus*, Portal, Arizona. The type specimens are in the University of Minnesota Entomology Collection.

Diagnosis

Total body length: female about 0.96 mm; male about 0.77 mm. Closely allied to *H. reithrodontomydis* Ferris, *H. difficilis* sp. n., *H. hesperomydis* (Osborn) and *H. ferrisi* Cook and Beer. It differs from *ferrisi* in having MMHS close to PPHS, paratergal lobes of 4th and 5th segments with acute lateral lobules, and also separable from *reithrodontomydis*, *difficilis*, and *hesperomydis* in having posterior process of thoracic sternal plate blunt or even truncate, at least one paratergal seta of abdominal segments 4 to 6 as long or longer than the depth of median emargination. Male further separable from *difficilis*, *hes-*



H. ONYCHOMYDIS COOK & BEER



H. FERRISI FERRISI COOK & BEER

FIGURES 27-30. *Hoplopleura onychomydis* Cook and Beer. 27. Paratergites of abdominal segments 1-8. 28. Thoracic sternal plate, female. 29. Dorsal view of head. 30. Male genitalia.

FIGURES 31-36. *Hoplopleura ferrisi ferrisi* Cook and Beer. 31. Paratergites of abdominal segments 1-8. 32. Thoracic sternal plate, female. 33. Dorsal view of head. 34. Female genitalia. 35. Thoracic sternal plate, male. 36. Male genitalia.

peromydis and *reithrodontomydis* by having basally thickened paramere.

Specimens examined

Holotype, allotype and paratypes including 13 females, 11 males, 7 third nymphs, 15 second nymphs, and 23 first nymphs. Data for the type specimens are as in "Type data." Two collections: Ex *Onychomys torridus pulcher* Elliot, CALIFORNIA: Victorville, no other data, 1 female; Ex *O. leucogaster arctipes* Rhoads, COLORADO: Colorado Springs, no other data, 2 males.

5. *Hoplopleura ferrisi ferrisi* Cook and Beer

(Figs. 31-36)

Hoplopleura ferrisi Cook and Beer, 1959, J. Parasit. 4: 408, figs. 8, 18.

Hoplopleura hesperomydis (Osborn) (*partim*), Ferris, 1916b, p. 155 (*err. det.*, the records from *Peromyscus boylii*); Ferris, 1921, p. 70 (the records from *P. boylii*); Hopkins, 1949, p. 471 (the records from *P. boylii*); Ferris, 1951, p. 136-137 (the records from *P. boylii*); Morlan and Hoff, 1957, p. 348-349 (*err. det.*, the records from *P. boylii rowleyi* (Allen) and *P. nasutus nasutus* (Allen)).

Type data

Holotype: 1st instar nymph from *Peromyscus boylii* (Baird), Portal, Arizona, 5 August 1957, collected by James R. Beer and Robert Schwab. Paratypes: 6 males, 13 females, 13 first instars, 33 second instars, 3 third instars, collected from the same host specimen. Other paratypes are from *Peromyscus nasutus* (Allen), *P. eremicus* (Baird). Types in the University of Minnesota Entomology Collection.

Diagnosis

Total body length: female about 1.06 mm; male about 0.90 mm. Related to *H. ferrisi emphereia* subsp. n., *H. onychomydis* Cook and Beer, *H. reithrodontomydis* Ferris, *H. hesperomydis* (Osborn) and *H. difficilis* sp. n. Females separable from *ferrisi emphereia* in having thoracic sternal plate with posterior process gradually acute and paratergite of 8th abdominal segment more or less symmetrical, and males also separable from *ferrisi emphereia* in having paramere gradually tapering posteriorly. It differs from *onychomydis*, *reithrodontomydis*, *hesperomydis*, and *difficilis* by having MHS arranged in more or less straight line, paratergal lateral lobes of 4th and 5th abdominal segments truncate, and parameres basally thickened.

Specimens examined

Holotype and paratypes from *P. boylii* as in "Type data." Other paratypes: Ex *Peromyscus nasutus*, ARIZONA: Portal, 6-9 August 1957, 61 males, 83 females, 34 third instars, 125 second instars, and 67 first instars, collected by James R. Beer; Ex *P. eremicus*, ARIZONA: Portal, 27-29 July 1957, 2 males, collected by James R. Beer; New

MEXICO: Wilna, 3 June 1955, 1 female, 10 second instars and 6 first instars, collected by James R. Beer. Ex *P. boylii*, ARIZONA: Portal, June-July, 1957, 5 males and 6 females, collected by James R. Beer.

Comment

This species was originally described on the basis of characters found solely in the immature stages. A quantitative analysis or discriminant function of the adult stages reveals that the population of *H. hesperomydis* from *Peromyscus leucopus* and *P. maniculatus* can be, however, distinctly discriminated from that of *H. ferrisi* found on the *P. boylii*, *P. nasutus* and *P. eremicus*.

6. *Hoplopleura ferrisi emphereia* subsp. n.

(Figs. 37-42)

Type data

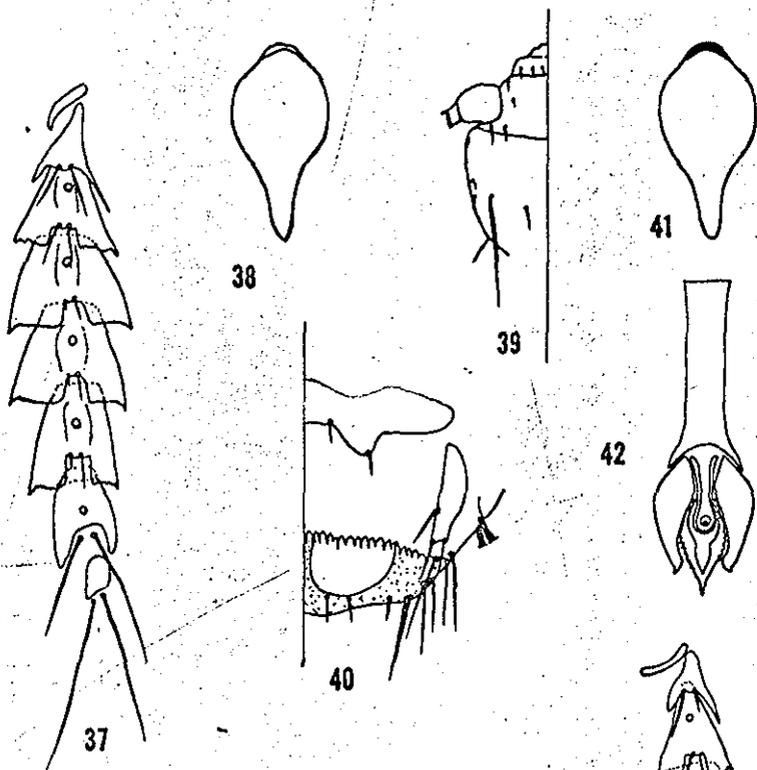
Holotype: a female from *Peromyscus nudipes* (Allen), PANAMA: Chiriqui, El Hato, Lava Flow, 5,000 ft, 7 Jan. 1961, collected by Tipton. Allotype: male, data same as holotype. Holotype and allotype are on one slide. Paratypes: Ex *P. nudipes*, PANAMA: Chiriqui, El Hato, Lava Flow, 5,000 ft, 7-8 Jan. 1961, 3 males and 7 females, collected by Tipton, Chiriqui, El Volcan, 12 Jan. 1961, 1 male and 1 female, by Tipton, Chiriqui, Martinz Dairy, 6,800 ft, Cerro Punta, 7-8 Jan. 1961, 2 males and 12 females, by Tipton; Ex *P. guatemalensis* Merriam, GUATEMALA: Dept. Jalapa, 5 miles E Mataquesuinta, Lasolidao, 21 March 1951, 1 female, collected by L. de la Torre; Ex *P. mexicanus saxatilis* Merriam, GUATEMALA: Dept. Santa Rosa, Finca El Progreso, 25 July 1951, 1 male, collected by L. de la Torre. Type host: *P. nudipes* (Allen). Type locality: Chiriqui, El Hato, PANAMA.

Diagnosis

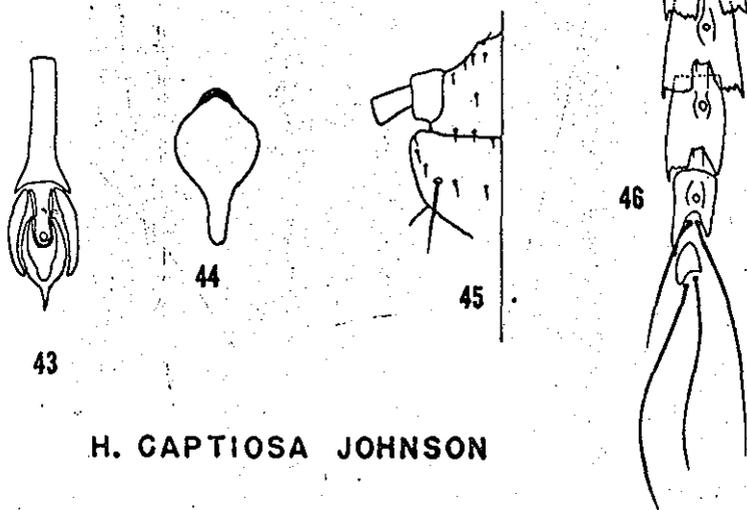
Very closely related to *H. ferrisi ferrisi* Cook and Beer. Female differs from *ferrisi* by having thoracic sternal plate with posterior process abruptly pointed, and males further separable in having paramere posteriorly abruptly tapering.

Description

Female: Total body length about 1.27 mm. *Head* (Fig. 39): MHS arranged in more or less straight line. Antennae 5-segmented; scape wider than long and as long as pedicel. *Thorax*: sternal plate with posterior process abruptly pointed as in Figure 38. *Legs* as in other member of genus. *Abdomen*: sternal plate of second segment with 2 groups of 4 setae extending laterally and articulating with paratergal plate. Anterior sternal plate of 3rd segment articulating with corresponding paratergal plate, bearing 2 groups of 2 enlarged setae. Ventral paratergal lobe of 2nd segment long and acute. Paratergal setae of 2nd and 3rd segments longer than depth of median emargination. Dorsal paratergal setae of segments 4 to 6 minute. Paratergites of 7th and 8th segments as in Figure 37. *Genitalia* as in Figure 40.



H. FERRISI EMPHEREIA SUBSP. NOV.



H. CAPTIOSA JOHNSON

FIGURES 37-42. *Hoplopleura ferrisi emphereia* subsp. n. 37. Paratergites of abdominal segments 1-8. 38. Thoracic sternal plate, female. 39. Dorsal view of head. 40. Female genitalia. 41. Thoracic sternal plate, male. 42. Male genitalia.

FIGURES 43-46. *Hoplopleura captiosa* Johnson. 43. Male genitalia. 44. Thoracic sternal plate, female. 45. Dorsal view of head. 46. Paratergites of abdominal segments 1-8.

Male: Total body length about 0.91 mm. *Head, legs, and abdomen* as in female with usual sexual differences. *Thorax:* posterior process of sternal plate more or less rounded, but not pointed. *Genitalia* as in Figure 42; paramere basally thickened and posteriorly abruptly tapering.

Comments

This species is very similar to *ferrisi* in general morphology, but distinctly different in male genitalia and female thoracic sternal plate. This species may well be treated as a distinct species, when we know more about the biology of the species and host.

7. *Hoplopleura captiosa* Johnson

(Figs. 43-46)

Hoplopleura captiosa Johnson, 1960, U. S. Dept. Agr. Tech. Bull. 1211: 23-28, figs. 23, 24, c; 25, c; 26, 27, 32, 37, A, B.

Hoplopleura hesperomydis (Osborn) (*partim*), Ferris, 1916b, "Cat. Anop.", p. 155 (records from *Mus musculus*, Calif., USA); Ferris, 1916a, p. 112 (*err. det.*, records from *Mus musculus*); Ferris, 1921, p. 70-72 (*err. det.*, records from *Mus musculus* in Russian Turkestan, Virginia, USA, and China); Blagoveschtchensky, 1937, p. 44 (*err. det.*, *Mus musculus*, southern Kazakhstan; *fide* Johnson, 1960); Hopkins, 1949, p. 482 (records from *Mus musculus*); Blagoveschtchensky, 1950, p. 85 (*err. det.*, from *M. musculus*, Tadzhikistan; *fide* Johnson, 1960); Ferris 1951, p. 136-137 (records from *Mus musculus*); Sosnina, 1951, p. 365 (*err. det.*, from *M. musculus*, Tadzhikistan *fide* Johnson, 1960; Sosnina 1954, p. 167 (*err. det.*, from *M. musculus*, Tadzhikistan; *fide* Johnson, 1960).

Hoplopleura acanthopus (Burmeister), O'Mahoney, 1944, p. 60 (*err. det.*, from *M. musculus*, Cairo, Egypt; *fide* Johnson, 1960); O'Mahoney, 1946, p. 231 (*err. det.*, from *M. musculus*, South Altai Mountain, Russia; *fide* Johnson, 1960).

Hoplopleura intermedia Kellogg and Ferris, Kaneko, 1955, p. 109, figs. 4, 5 (*err. det.*, from *Suncus murinus* and *Mus caroli*; *fide* Johnson, 1960).

Hoplopleura musculi Wegner, 1961, p. 155-164, figs. 1, 2, 3 (new synonymy).

Type data

Holotype female, allotype male, 4 males and 19 female paratypes from *Mus musculus* Linn., Egypt: Western Desert Governorate, Royal Shooting Club, 3 miles N of Faiyum, 4 Jan. 1954, collected by Hoogstraal. Other paratypes from *Thos* sp., *Mus* sp., *Mus musculus* sp. Egypt. *Mus cervicolor*, Thailand, *M. musculus*, Russian Turkestan, *Mus bacterianus*, Ryukyu, Japan, *Mus caroli*, Ryukyu, Japan, *M. musculus*, California, USA. Holotype and allotype deposited in the collections of U. S. National Museum, type no. 64468.

Diagnosis

Total body length: Female, 1.2 to 1.35 mm, male 0.85 to 0.95 mm. Related to *H. similis* sp. n., *H. cooki* sp. n., and *H. hesperomydis* (Osborn). Separable in both male and female from *hesperomydis* in having 3rd abdominal segment with a single paratergal seta on each side and ADIIS present. Female differs from *similis* and *cooki* by having ordinary genital setae, several setae present on abdominal membrane between sternal plates and paratergites, thoracic sternal plate with posterior process rounded and 3rd abdominal segment with 2 paratergal setae on each side.

Specimens examined

Ex *Mus musculus*, CHINA: Chou, Kansu, 1 male and 1 female (Ferris' collection); Tai-Yuan-Fu, Shansi, 1 male and 1 female (Ferris' collection); EGYPT: West. Desert Gov., Royal Shoot. Club, 3 miles N of Faiyum, 4 Jan. 1954, by H. Hoogstraal, 1 female paratype; UNITED STATES: Virginia, Falls Church, 2 females, 1915, collected by E. A. Chapin (Ferris' collection); USSR: Dzharkent, Russian Turkestan, 3 males and 3 females (Ferris' collection).

Comments

Wegner (1961) described *H. musculi* from *Mus musculus* as new without any reference to Johnson's work. The description of Wegner's *musculi* agrees with Johnson's description of *captiosa*. Wegner (personal communication, 21 Nov. 1964) also pointed out that the taxonomic characters of *captiosa* Johnson coincides with the characters of *musculi* Wegner.

8. *Hoplopleura similis* sp. n.

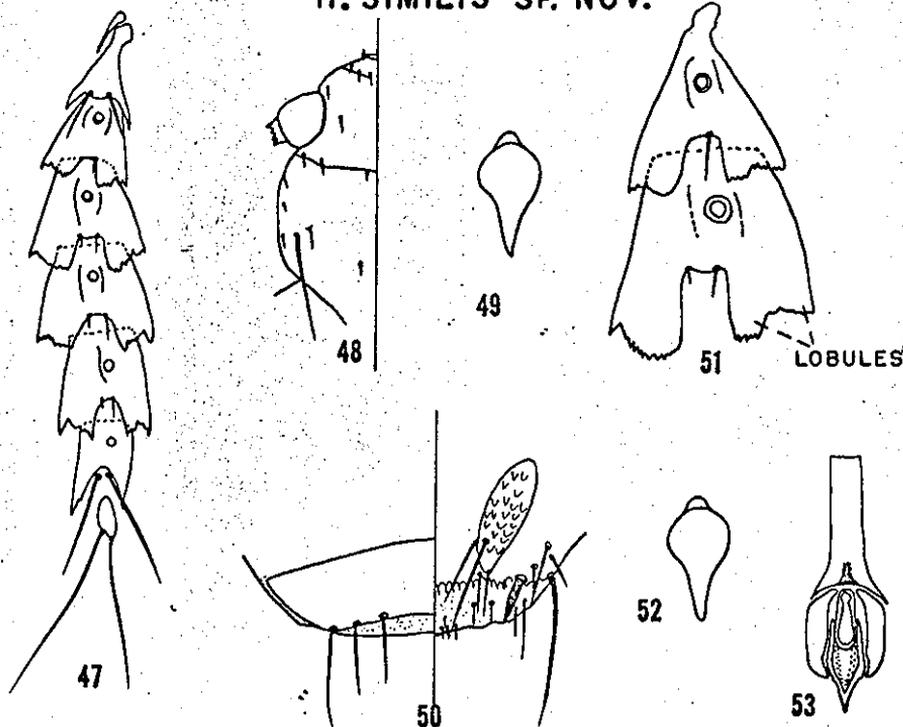
(Figs. 47-53)

Hoplopleura hesperomydis (Osborn) (*partim*), Ferris, 1921, p. 70-72 (*err. det.*, records from *Oryzomys fulvescens* and *O. chaparensis*); Hopkins, 1949, p. 469 (records from *O. fulvescens* and *O. chaparensis*); Ferris, 1951, p. 136-137 (the records from *O. fulvescens* and *O. chaparensis*).

Type data

Holotype: female from *Oryzomys fulvescens* Saussure, Vera Cruz, Orizaba, Mexico, no other data, Ferris' collection 951 (USNM 58259). Allotype: male from *Oryzomys chaparensis* Osgood; Todos Santos, Bolivia, no other data, Ferris' collection 1021 (USNM not listed). Paratypes: 7 females from *O. fulvescens*, Vera Cruz, Orizaba, Mexico; 2 females from *O. chaparensis*, Todos Santos, Bolivia. The type specimens are deposited in the collections of the University of California at Berkeley, California except 2 female paratypes (on one slide) which are kept in the University of Minnesota. Entomology Collection. Type host: *Oryzomys fulvescens* Saussure. Type locality: Vera Cruz, Orizaba, Mexico.

H. SIMILIS SP. NOV.



FIGURES 47-53. *Hoplopleura similis* sp. n. 47. Paratergites of abdominal segments 1-8. 48. Dorsal view of head. 49. Thoracic sternal plate, female. 50. Female genitalia. 51. Paratergites of third and fourth abdominal segments. 52. Thoracic sternal plate, male. 53. Male genitalia.

Diagnosis

Closely allied to *H. cooki* sp. n. and *H. captiosa* Johnson. It differs in both male and female from *cooki* by having abdominal segment 8 without distinct lateral paratergal lobe, thoracic sternal plate with posterior process gradually tapering and acute, abdominal segment 3 with a single paratergal seta placed near ventral angle of median emargination and PMHS placed in parallel with PDHS. Separable from *captiosa* in having abdomen with no setae on membrane, thoracic sternal plate with posterior process pointed, 3rd abdominal segment with a single paratergal seta on each side, and also separable in female from *captiosa* by having spinulum genital setae.

Description

Female: Total body length about 1.25 mm. **Head** (Fig. 48) with MHS in straight line and ADHS near PDHD; PMHS placed in parallel with PDHS. Antennae 5-segmented; scape wider than long and as long as pedicel. **Thorax:** sternal plate with posterior process gradually tapering and acute as in Figure 49. **Legs** as in other member of the

genus. **Abdomen:** sternal plate of 2nd segment with 2 groups of 4 setae extending laterally and articulating with paratergal plate; anterior sternal plate of 3rd segment articulating with corresponding paratergal plate bearing 2 groups of 2 enlarged setae. Paratergite of 3rd segment with 1 paratergal seta and each paratergal lobe divided into 2 distinct lobules (Fig. 47). Paratergal setae of segments 4 to 6 distinct but dorsal paratergal setae very small. Paratergite of 7th segment with distinctly pointed lateral lobes, bearing 2 long setae. Paratergite of 8th segment asymmetrical with 2 long setae. Last tergite with 3 long setae on each side. **Genitalia** (Fig. 50): genital setae flat, spiniform.

Male: Total body length about 0.86 mm. **Head, legs, and abdomen** as in female with usual sex differences. **Thorax:** sternal plate with posterior process not acute as in Figure 52. **Genitalia** as in Figure 53: paramere of uniform thickness.

Comments

This species has been mistakenly identified as *hesperomydis*.

9. *Hoplopleura cooki* sp. n.

(Figs. 1-6)

Hoplopleura hesperomydis (Osborn) (*partim*), Ferris, 1921, p. 70-72 (*err. det.*, records from *Hesperomys callosus* = *Eligmodontia collisae*); Hopkins, 1949, p. 472 (records from *Hesperomys callosus*); Ferris 1951, p. 136-137 (records from *Hesperomys callosus*).

Type data

Holotype female, allotype male, 2 male and 2 female paratypes from *Hesperomys callosus*, ARGENTINA, Joya, no other data, Ferris' Collection 942 (USNM 94164). Type host: *Hesperomys callosus* (Rengger). Type locality: Joya, Argentina. Holotype, allotype, and 2 paratypes deposited in the collections of the University of California at Berkeley, California. One male and 1 female paratypes (on one slide) are kept in the University of Minnesota Entomology Collection.

Diagnosis

Closely related to *H. similis* sp. n. Separable in both male and female from *similis* in having 8th abdominal segment with distinct dorsal paratergal lobe acute, thoracic sternal plate with posterior process abruptly pointed, single paratergal seta of 3rd abdominal segment placed on middle of medial emargination and PMHS placed anterior to PDHS.

Description

Female: Total body length about 1.27 mm. **Head** (Fig. 1): PMHS placed anterior to PDHS; ADHS close to PDHS. Antennae 5-segmented scape wider than long and as long as pedicel. **Thorax:** sternal plate with posterior process rather short and abruptly pointed as in Figure 6. **Legs** as in other member of the genus. **Abdomen:** sternal plates of 2nd and 3rd segments as other members of the genus. Ventral paratergal lobe of 2nd segment acute. Dorsal paratergal seta of 2nd segment longer than ventral one. Paratergite of 3rd segment with a single paratergal seta placed on the middle of anterior edge of median emargination. Paratergal lateral lobes of segments 4 to 6 more or less truncate. Dorsal paratergal setae of segments 4 to 6 minute. Paratergal lateral lobes of 7th segment distinct and pointed. Paratergites of 7th and 8th segments with 2 long setae. Paratergite of 8th segment asymmetrical and with a distinct dorsal paratergal lobe acute (Figs. 2, 3). Last tergite with 3 setae on each side. **Genitalia** (Fig. 4): genital seta flat spiniform.

Male: Total body length about 0.98 mm. **Head, thorax, legs, and abdomen** as in female with usual sex differences. **Genitalia** as in Figure 5: paramere evenly thickened.

Comments

This species is named in honor of Dr. Edwin F. Cook to whom the author owes a most profound debt of gratitude for both personal and scientific guidance, assistance, and inspiration.

ACKNOWLEDGMENTS

I am grateful to my former major professor, Dr. Edwin F. Cook, Professor, Department of Entomology, Fisheries, and Wildlife, University of Minnesota, St. Paul, Minnesota, for his suggestion of the problem, guidance during the research and reading the manuscript.

The author is also indebted to Dr. Robert L. Langston, Senior Museum Scientist, Division of Entomology and Acarology, College of Agriculture, University of California, Berkeley, California, and Drs. K. C. Emerson and Oliver S. Flint, Jr., Department of Entomology, U. S. National Museum, Washington, D. C. for the bulk of the materials on which part of this work was based, and to Dr. Roger D. Price for reading the manuscript.

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