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NOTES ON SAPROGLYPHID MITES ASSOCIATED
WITH SOLITARY WASPS

(ACARINA: SAPROGLYPHIDAE)

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This paper is an introductory study to certain saprogllyphids found associated with solitary wasps, and is by no means to be considered as a definitive work. A comprehensive review of the group will take years and much more collecting and study. The information here presented has been made possible by the studies on the biology of the solitary wasps by K. V. Krombein, of the U. S. Department of Agriculture. All the mites mentioned in this paper were removed from nests under study or collected from wasps in the U. S. National Museum by Dr. Krombein. The information gathered indicates that each wasp is parasitized by its own species of mite. Although the specific characters separating these mites species are small, they are constant within the small series studied, especially in the hypopial nymphs which a collector almost invariably encounters. Adults are at present little known, and the characters found useful in other groups for species differentiation are, in these mites, of little use. It is possible that in the evolution of these mites there has been little differentiation because of the close similarity of the habitats on the wasps and in the nests.

Too few species are available to develop a satisfactory systematic arrangement, or to determine if an arrangement might follow the one accepted for the wasps. The structure of the ventral apodemes of the hypopi separates the mites into groups. However, the apodemes may be of secondary importance, and other more minute characters may be of greater importance in interpreting evolutionary trends.

Generic and specific characters in the hypopi are to be found in the location of the eyes, in the structure of the ventral apodemes, in some cases in the structure of the suctorial plate and its discs, in the leg setation, and in the type of tarsal appendages. Descriptions are difficult and figures should be referred to for specific determinations.

There has been very little previous work. Vitzthum (1925), and Cooreman (1942, 1954) each has described a genus and species. Zachvatkin (1941) in a very comprehensive paper described and gave keys to the mites in this and related groups. Cooper (1955) has discussed

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venercal transmission of hypopi from male to female wasps. Hughes and Jackson (1958), Turk and Turk (1957), and Scheucher (1957), have discussed sarcoptiform mites that possess hypopial stages.

A key to the families of sarcoptiform mites may be found in Baker *et al* (1958). The family Glycyphagidae, as defined by Zachvatkin, included several subfamilies, some of which should be raised to family status, giving us the Labidophoridae, the Chaetodaetylidae, the Chortoglyphidae, and the Carpoglyphidae. We are concerned here only with the Saproglyphidae with the hypopial stages. These hypopi are active; they have sucking discs, short, stout legs, with tarsi and tibiae III and IV short and stout, with long, strong pretarsi bearing empodial claws (the pretarsus and claw may be missing on leg IV), and with the gnathosoma missing, being represented only by setae.

The adults may be described as follows: The genital opening of the female is large, triangular, longitudinal, with well-developed genital discs. These discs are relatively large in the free-living forms such as *Czenspínskia*, and small in those associated with wasps. The caruncles are broadly connected to the tarsus, not stalked, elongate; the empodial claw lies free in the caruncle, not being connected to the tarsus by small rods; the skin is smooth or striate; the body setae are smooth. Most of the mites are small, but those found on wasps are large. Many saproglyphids are free living, and it is possible that a detailed study will show enough differences between those associated with wasps and those that are free living to separate them into two groups.

KEY TO THE GENERA OF SAPROGLYPHID HYPOPI

1. Without well-developed gnathosoma 2
 With well-developed gnathosoma; with eyes **Calvolia** Oudemans, 1911
2. Tarsus IV sharp distally 3
 Tarsus IV blunt distally and with terminal setae **Vidia** Oudemans, 1905
3. Tarsus IV with pointed distal tip, but without thornlike process 4
 Tarsus IV with pointed tip; tarsus III and IV each with a thornlike process **Ensliniella** Vitzthum, 1925
4. Small seta of tarsus IV minute, spinelike; gnathosomal setae long 5
 Small seta of tarsal IV relatively large, broad, lanceolate; gnathosomal setae short **Kennethiella** Cooreman, 1954
5. Coxal apodemes III-IV not meeting medially **Monobiacarus**, new genus
 Coxal apodemes III (when complete)-IV meeting medially **Vesparacarus**, new genus

Monobiacarus, new genus

Adult.—In the known adults of both sexes, all body setae slender, whiplike; venter with two pairs of genital setae, three pairs of anal setae, and two pairs of ventral setae; body globose, legs relatively small.

Hypopus.—Dorsal body setae short, propodosomal setal bases not in straight line but in a gentle arch; gnathosomal setae long, ventral pair far surpassing in length the other pair and reaching well past the margin of the body, lateral pair missing; integument in this and other genera discussed, striate, punctate; eyes on anterior margin of body; apodemes I not fused with apodemes II; apodemes III and IV

not meeting medially, but separated by only a short distance; tarsus IV sharp distally, the setae arising from below the apex of the segment; small seta of tarsus IV long, lanceolate; a small spinelike fifth seta present; tarsus III with one long whiplike seta, four large lanceolate setae, and a short seta; tarsus III blunt distally, and the pretarsus arises from the apex; true (functional) suckers on sucrotorial plate small, smaller than discs.

Type.—*Monobiacarus quadridens*, new species. Type by original designations.

***Monobiacarus quadridens*, new species**
(Figs. 1-8, 11, 111)

Female.—This is the only species in the genus in which males and females are known. The female is figured and has been briefly described in the generic description. It is a large mite, being 1450 μ long.

Male.—The male is similar, but with a smaller body measuring 770 μ in length; the legs and body setae appear relatively long.

Hypopus.—Body broadest at middle, tapering posteriorly. Eyes anterior dorsal-lateral, separated by a distance subequal to the width of each; gnathosomal setae of normal length, as figured. Apodemes III and IV as figured. Tarsus IV with three long whiplike setae, one being abruptly attenuate near its base, one short spinelike seta, and one swordlike seta of medium length and of equal strength throughout; tibia IV with spinelike seta of medium length and rodlike sensory seta barely discernible, seen only as a dark mark. Tarsus III with empodial claw with inner basal protuberance, with four large lanceolate setae, one long whiplike seta, and a short spinelike seta; tibia III with a tactile seta of medium length and a sensory seta about one-third longer. Length 255 μ .

The position of the eyes and the setal pattern of tarsus IV are distinctive in the hypopus stage.

The holotype hypopus, U. S. National Museum No. 2568, and 9 paratype hypopi were collected at Kill Devil Hills, North Carolina, August 4, 1956. Other material examined was from nests collected at Lake Placid, Florida, as follows. Eleven females and one male, September 25, 1957; two females, January 28, 1958; three females, February 3, 1958 (these were collected from the genitalia of the male wasps). Six hypopi were taken from a nest January 28, 1958. All were associated with *Monobia quadridens* (L.). All material was collected in Washington, D. C.

***Monobiacarus funebris*, new species**
(Figs. 13-16, 97, 109)

Male and female.—Not known.

Hypopus.—Body broadest at middle, similar to *M. quadridens*. Anterior margin of the propodosoma sharply rounded; gnathosomal setae long, as figured; anterior propodosomal setae of medium length; eyes separated by a distance subequal to one third of the width of each, located anteriorad and laterad on the propodosoma. Tarsus IV with three long whiplike setae—one much more slender than the others, a small spinelike seta, and a swordlike seta which expands from the base to the

distal third and then tapers to a point; tibia IV with spinelike seta but no rodlike sensory seta, the base being all that remains. Tarsus III with the usual empodial claw with the basal thumb more hooklike than in the other two species, the four large lanceolate setae, the long whiplike seta, and a rodlike rather than spinelike small seta; tibia III with sensory seta only slightly longer than tactile seta. Length 293 μ .

The location of the eyes and the setal pattern of tarsus IV are distinctive.

The holotype hypopus, U. S. National Museum No. 2567, and 16 paratype hypopi were collected from *Monobia apicalipennis* var. *funbris* Grib., Santa Rosa, Veracruz, Mexico, August—(W. Schaus, colr.) (no other data given). Specimens were collected from the acarinarium at the base of the second abdominal tergite by K. V. Krombein, Washington, D. C., 1957.

***Monobiacarus insularis*, new species**

(Figs. 9-12, 96, 110)

Males and Females.—Not known.

Hypopus.—Anterior margin of propodosoma rounded, eyes set anteriorly and separated by a distance subequal to one-fourth of the width of each. Gnathosomal setae as figured, the anterior propodosomals short. Apodemes III with anterior "horn" not as well developed as in other species. Tarsus IV with three long whiplike setae, two stout and one slender, one small spinelike seta, and a large flat swordlike seta which gradually tapers to a point; tibia IV with a spinelike seta but without a rodlike sensory seta, only the setal base remaining. Tarsus III typical for the genus, with four large lanceolate setae, the single long whiplike seta, but the "small spinelike" seta is strong and prominent; the sensory and tactile setae of tibia III are subequal and of medium length. Length 255 μ .

The hypopus is similar to that of *quadridens*, but differs in the location of the eyes, and in the setation of the leg.

The holotype hypopus, U. S. National Museum No. 2569, and 8 paratype hypopi were collected in Washington, D. C., by K. V. Krombein from the acarinarium of a male *Monobia angulosa* var. *insularis* (Ashm.) from San Rafael, Jicoltepec, Mexico (no other data given).

***Ensliniella* Vitzthum, 1925**

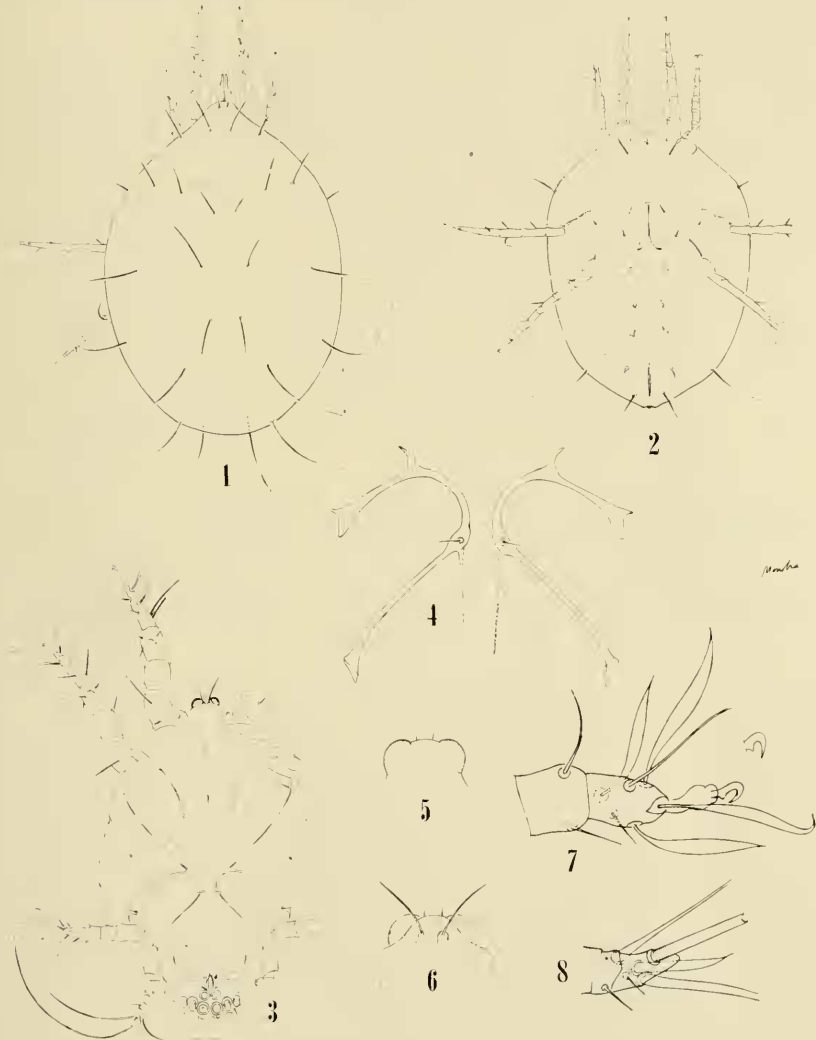
Vitzthum, H. G., 1925, Eine neue Milbengattung und -art als Parasit von *Odynerus* (*Lionotus*) *delphinialis* Giraud 1866. Deutsch. Ent. Zeitschr. IV: 239-305.

Adults.—The adults are not recognizable in detail from the original figures, but they appear to be near *Vesparacarus*, new genus. The hypopial forms must be used for generic differentiation.

Hypopus.—Dorsal body setae short except for the propodosomal humerals (DM5 of Hughes and Jackson); the setae bases of the propodosomals are so arranged that they almost form a square, the inner pair being far forward and only slightly closer together than the outer pair; gnathosomal setae short to long, the paired setae always long; eyes on anterior margin of body; apodemes I united, not connected with apodemes II which are free posteriorly; coxal apodemes III and IV united; tarsus III and IV each with thornlike process distally; tarsus IV with

two long whiplike setae, one short spinelike seta, and a large flat lanceolate seta; tarsus III with four large lanceolate setae, one long whiplike seta, and a short spinelike seta; functional suckers of suetorial plate smaller than discs.

Type. Enstiniella parasitica Vitzthum, 1925. Monotypical.



Monobiacarus quadridens, new species. Fig. 1, dorsal view of female; fig. 2, ventral view of female; fig. 3, ventral view of hypopus; fig. 4, coxal apodemes III and IV of hypopus; fig. 5, dorso-anterior part of propodosoma of hypopus; fig. 6, ventral view of same region; fig. 7, tibia and tarsus III of hypopus; fig. 8, tibia and tarsus IV of hypopus.

Ensliniella parasitica Vitzthum, 1925

(Figs. 42-46, 100, 105)

Ensliniella parasitica Vitzthum, 1925. Eine neue Milbengattung und -art als Parasit von *Odynerus (Lionotus) delphinalis* Giraud 1866. Deutsch. Ent. Zeitschr. 4: 289-305. Cooreman, J. 1942. Notes et observations sur les acariens. II. Bull. mus. roy. hist. nat. Belg. XVIII (58): 1-12.

Adults.—Known only from figures by Vitzthum.

Hypopus.—Elongate, narrowing posteriorly. Eyes prominent, set very close together, almost touching, on anterior margin of propodosoma. Anterior propodosomal setae shorter than gnathosomals which are long and of equal length. Coxal apodemes III nearly straight on anterior margin and only slightly indented at median junction; apodemes IV form less than a 45 degree angle with each other; sternum reaches posteriorly past distal ends of apodemes IV. Apodemes VI contiguous with apodemes of suctorial plate. Tarsus IV with strong, blunt thornlike process, two long whiplike setae, one short spinelike seta, and a broad but distally attenuated seta about two times as long as thornlike process; setae on tibia IV of medium length, the sensory rod slightly longer than the tactile seta. Tarsus III with empodial claw, a strong blunt thornlike process, four large lanceolate setae, one long whiplike seta, and one short, spinelike seta; tibia III with tactile seta of medium length, and a sensory seta which is about three times longer. Functional suctorial discs smaller than in the other two species. Length 268 μ .

This species is similar to *aegyptiana* in the structure of the posterior coxal apodemes and those of the suctorial plate, but differs in that both pairs of gnathosomal setae are long and of equal length.

Six hypopi were collected in Washington, D. C., by K. V. Krombein, 1957, from *Allodynerus delphinalis* (Gir.), δ , η , Lido, Venezia, Italy, July 31, 1934 (A. Giordani Soika, colr.).

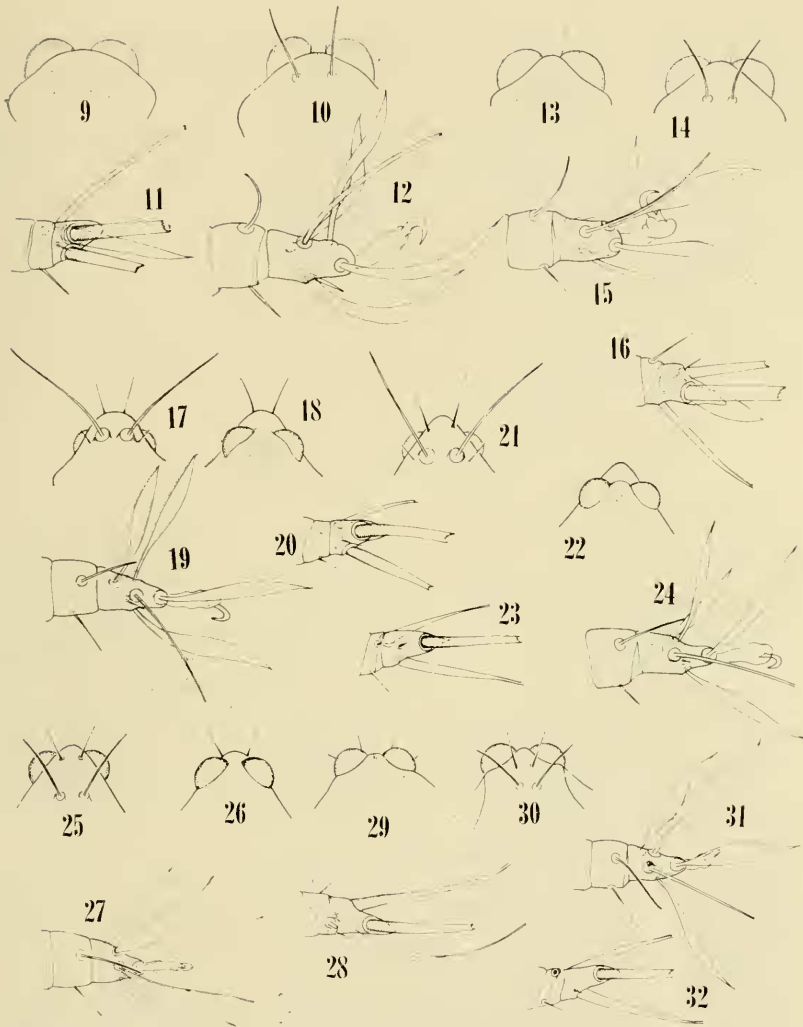
Ensliniella aegyptiana, new species

(Figs. 33-37, 98, 106)

Males and females.—Not known.

Hypopus.—The body is broadest medially, although this may be due to mounting and flattening. The eyes large, anterior and marginal, and separated by a distance subequal to one-third of the width of each. Anterior propodosomal setae short; the medial gnathosomal setae long, and the laterals short. Apodemes III and IV as figured, III indented medially (mounting may distort the appearance of this indentation); apodemes IV form more than a 45 degree angle with each other. Apodemes VI (see Hughes and Jackson) not connecting with apodemes of suctorial plate. Tarsus IV with a strong blunt thornlike process, with two long whiplike setae, with one short spinelike seta, and a broad, distally attenuate seta that is

Monobiacarus insularis, new species. Fig. 9, dorso-anterior part of propodosoma of hypopus; fig. 10, ventral view of same region; fig. 11, tibia and tarsus IV of hypopus; fig. 12, tibia and tarsus III of hypopus. *Monobiacarus funebris*, new species. Fig. 13, dorso-anterior part of propodosoma of hypopus; fig. 14, ventral view of same region; fig. 15, tibia and tarsus III of hypopus; fig. 16, tibia and



tarsus IV of hypopus. *Vespacarus rufovestis*, new species. Fig. 17, ventral view of anterior part of propodosoma of hypopus; fig. 18, dorsal view of same region; fig. 19, tibia and tarsus III of hypopus; fig. 20, tibia and tarsus IV of hypopus. *Vespacarus saccularis*, new species. Fig. 21, ventral view of anterior part of propodosoma of hypopus; fig. 22, dorsal view of same region; fig. 23, tibia and tarsus IV of hypopus; fig. 24, tibia and tarsus III of hypopus. *Vespacarus pedestris*, new species. Fig. 25, ventral view of anterior part of propodosoma of hypopus; fig. 26, dorsal view of same region; fig. 27, tibia and tarsus III of hypopus; fig. 28, tibia and tarsus IV of hypopus. *Vespacarus vagus*, new species. Fig. 29, dorsal view of anterior part of propodosoma of hypopus; fig. 30, ventral view of same region; fig. 31, tibia and tarsus III of hypopus; fig. 32, tibia and tarsus IV of hypopus.

about three times as long as that on *parasitica*; tarsus III with an empodial claw, a small, sharp thornlike process, and the usual lanceolate whiplike setae; tibia III with the tactile and sensory setae similar to those in *parasitica*, the sensory seta being three times as long as the tactile. Length 248 μ .

This species is easily separated from the other two in the genus in that the apodemes of the large disc of the suctorial plate are free and do not connect with the last apodeme of coxae IV.

The holotype hypopus, U. S. National Museum No. 2580, and eight paratype hypopi were collected in Washington, D. C., by K. V. Krombein, 1957, from *Allodynerus vinciguerrae* (Guiglia), ♀, Abu Suttan, Egypt, August 14, 1949 (D. B. Baker, colr.). The hypopi of this and the other two species described here were collected from a small, rounded flat area on the propodeum above the abdominal insertion in a small anterolateral pit adjacent to the disc of the scutellum, or occasionally beneath the apex of tergite I.

Ensliniella königi, new species

(Figs. 38-41, 99, 107)

Males and females.—Not known.

Hypopus.—The body is similar to that of the other two species; the anterior part of the propodosoma is similar to that of *egyptiana* in the position of the eyes and type of setae; the venter of the propodosoma is, however, more rounded; the medial gnathosomal setae long, the laterals short. Ventral apodemes III well indented anteriorly at median junction, rounded and not flat; apodemes IV form a 45 degree angle with each other; sternum reaches past posterior ends of apodemes IV. Apodemes VI contiguous with the apodemes of the suctorial plate. Tarsus IV similar to those of *parasitica* in setal pattern and type of thornlike process; tibia IV however, differing from *egyptiana* and *parasitica* in that both sensory and tactile setae are short and of equal length. Tarsus III possesses the usual empodial claw, the gently rounded thorn-like process intermediate in size between that of *egyptiana* and *parasitica*, and the other setae typical for the genus; tibia III with sensory seta about twice as long as tactile. Length 255 μ .

This species may be separated from *egyptiana* in that the apodemes of the suctorial plate and apodemes VI are contiguous, and from *parasitica* in that the tactile and sensory setae of tibia IV are subequal in length.

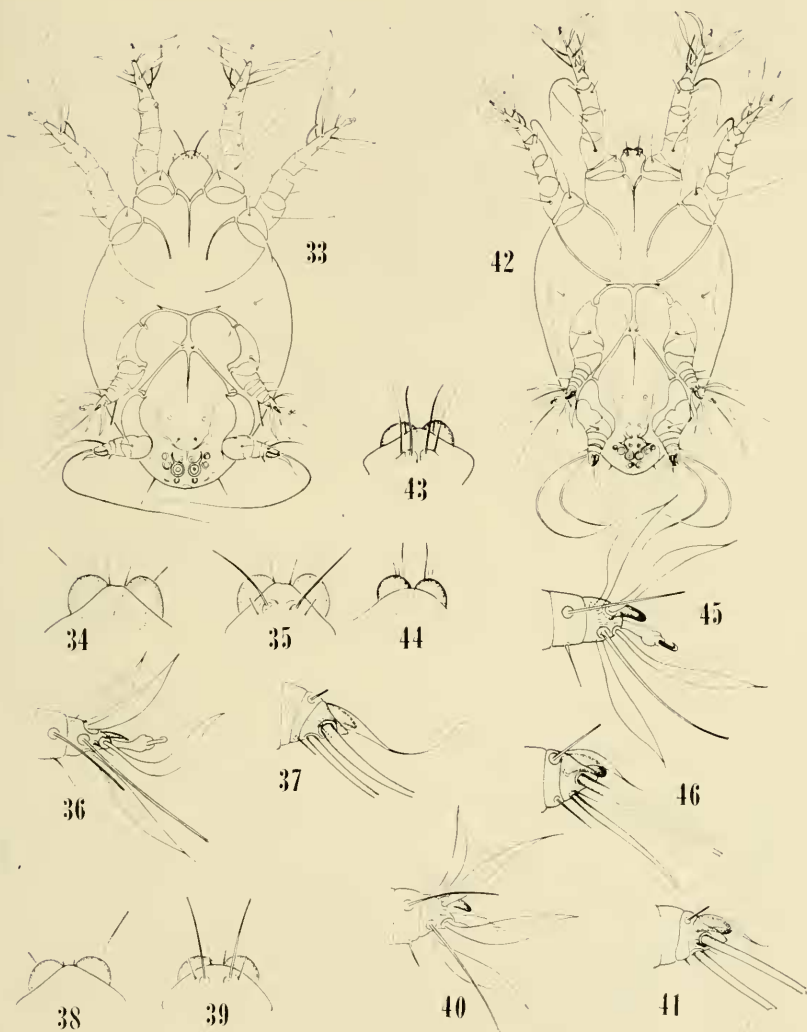
The holotype hypopus, U. S. National Museum No. 2571, and one paratype hypopus were collected in Washington, D. C., by K. V. Krombein, 1957, from *Allodynerus königi* (Dusmet), ♂, Ijonkak, Moyen Atlas, Maroc, May 9, 1947 (Naef, colr.).

Kennethiella Cooreman, 1954

Cooreman, 1954. Notes et observations sur les acariens. VI. Sur le Genre *Kennethiella* n. gn., parasite des Odyneres du genre *Ancistrocerus* Wesmael. Bull. inst. roy. sci. Belg. XXX (37): 1-10.

Adult.—Both sexes with strong, spinelike setae; with only a single pair of ventral or post-genital setae.

Hypopus.—All dorsal setae short; propodosomal setae bases not in a straight line but in a gentle arch; gnathosomal setae all short, of about equal size, not



Ensliniella aegyptiana, new species. Fig. 33, ventral view of hypopus; fig. 34, dorso-anterior part of propodosoma of hypopus; fig. 35, ventral view of same region; fig. 36, tibia and tarsus III of hypopus; fig. 37, tibia and tarsus IV of hypopus. *Ensliniella kónigi*, new species. Fig. 38, dorso-anterior part of propodosoma of hypopus; fig. 39, ventral view of same region; fig. 40, tibia and tarsus III of hypopus; fig. 41, tibia and tarsus IV of hypopus. *Ensliniella parasitica* Vitzthum. Fig. 42, ventral view of hypopus; fig. 43, ventral view of anterior part of propodosoma of hypopus; fig. 44, dorso-anterior part of propodosoma of hypopus; fig. 45, tibia and tarsus III of hypopus; fig. 46, tibia and tarsus IV of hypopus.

reaching past edge of body; eyes dorsal, not distal, apodemes I contiguous, not fused with apodemes II which are free posteriorly; coxal apodemes III and IV contiguous; small seta of tarsus IV lanceolate, larger than in the related mites; tarsus IV with one long whiplike seta, four large flat lanceolate setae, and one short spinelike seta; both tarsus III and IV pointed distally, pretarsi and setae arising from below apex; true suckers of suctorial plate larger than other discs.

Type.—*Ensliniella trisetosa* Cooreman, 1942. Monotypical.

***Kennethiella trisetosa* (Cooreman, 1942)**

(Figs. 47-54, 108)

Ensliniella trisetosa Cooreman, 1942. Notes et observations sur les acariens, II, Bull. mus. roy. hist. nat. Belg. XVIII (58): 1-12.

Kennethiella trisetosa Cooreman, 1954. Notes et observations sur les acariens, VI. Sur le genre *Kennethiella* n. gen., parasite des Odyneres du genre *Ancistrocerus* Wesmael. Bull. inst. roy. sci. nat. Belg. XXX (37): 1-10.

Ensliniella trisetosa Cooreman, 1942. Cooper, K. W., 1955. Venereal transmission of mites by wasps, and some evolutionary problems arising from the remarkable association of *Ensliniella trisetosa* with the wasp *Ancistrocerus antilope*. Biology of Eumenine Wasps II. Trans. Amer. Ent. Soc. LXXX: 119-174.

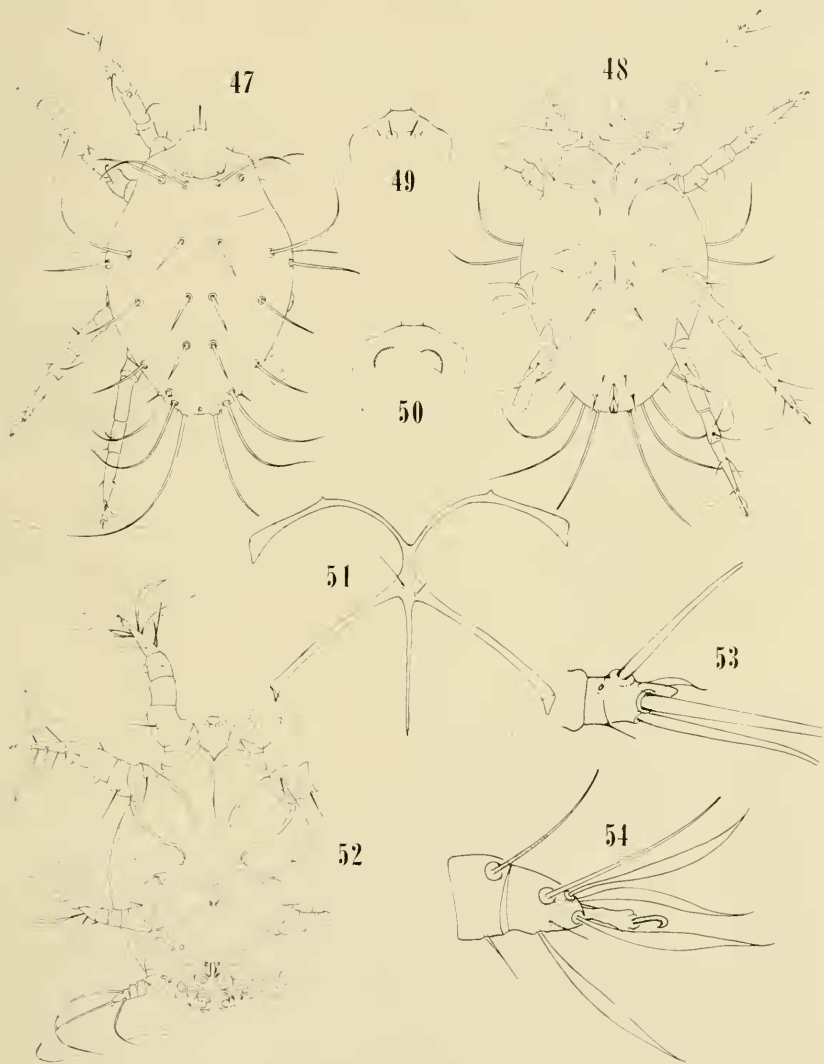
Female.—Elongate, narrowing anteriorly and posteriorly from midline, not bag-like. All dorsal body setae very strong except the anterior propodosomals which are relatively short and weak; the posterior propodosomals strong, long, about as long as propodosoma; hysterosomal setae of varying lengths, the three pairs of dorsomedians short and spiny, the marginals much longer and varying in length, the long posterior pair actually being the posterior anal setae. Ventral apodemes as figured. The two pairs of genital setae short, fine; the single pair of post-genital setae short, spinelike. The first two pairs of anal setae short, fine, the posterior pair strong, long, about $2/3$ the length of the body. Leg setae few, simple. Length of gravid female 850 μ ; nongravid female 690 μ .

Male.—Similar to female except for presence of aedeagus. Length 690 μ .

Hypopus.—The broad anterior part of the propodosoma bears the eyes dorsally; the anterior propodosomal setae and both pairs of gnathosomal setae are short and of equal length. The dorsal shield narrows rapidly behind legs IV. Apodemes III indented anteriorly at median junction; apodemes IV only very slightly curved and forming slightly more than a 45 degree angle with each other; sternum reaches slightly past posterior ends of apodemes IV. The suctorial plate as figured; the functional suckers large. Tarsus IV sharp distally, possessing three strong, long whiplike setae and one short broad lanceolate seta attenuate distally (sometimes this whiplike process is broken off giving the seta a spinelike appearance); tibia IV with short, barely discernible rodlike sensory seta and a tactile seta of medium length. Tarsus III with clawlike empodium, four large lanceolate setae, one long whiplike seta, and one short spinelike seta; tibia III with sensory seta at least three times as long as tactile seta. Length 287 μ .

The collections which were studied were made in Washington, D. C. by K. V. Krombein from *Ancistrocerus a. antilope* (Panz.) or their nests. The hypopi were taken on the propodeum of the δ wasps. There is no real acarinarium, only a modified surface area on the lateral and posterior surfaces of the propodeum.

Specimens were collected as follows. Derby, New York; adults and hypopi were taken from nests. Forest Lawn, Buffalo, New York; hypopi were taken from a ♂ wasp. Kill Devil Hills, North Carolina; one female was taken from a nest. Europe; hypopi were taken from



Kennethiella trisetosa (Cooreman). Fig. 47, dorsal view of female; fig. 48, ventral view of female; fig. 49, ventral view of anterior part of propodosoma of hypopus; fig. 50, dorsal view of same region; fig. 51, coxal apodemes III and IV of hypopus; fig. 52, ventral view of hypopus; fig. 53, tibia and tarsus IV of hypopus; fig. 54, tibia and tarsus III of hypopus.

specimens from Finland and "Europe" (these hypopi appear to have slightly longer gnathosomal setae).

Vespacarus, new genus

Hypopus.—Dorsal setae short except for outer propodosomals and hysterosomal humerals (*vagus* and *tigris* are exceptions); gnathosomal setae short to long, the paired setae long, the laterals short; eyes dorso-anterior or dorsal; apodemes I and II free as in other genera; apodemes III may be incomplete and not meet medially, or complete and meet medially with apodemes IV which connect medially; tarsus IV pointed distally; tarsus III ends bluntly; tarsus IV with four setae, three long and whiplike and one small spinelike; tarsus III with four large lanceolate setae, one long whiplike seta, and one small spinelike seta; functional suckers usually much smaller than discs.

Type.—*Vespacarus rufovestis*, new species. Type, by original designation.

The genus *Vespacarus* may be separated into two major groups: Those with apodemes III not connecting with apodemes IV; and those with apodemes III complete and connecting with apodemes IV. Group I may be further separated into two groups, those with sternum IV flanged and those with sternum IV daggerlike and not flanged. All of group II have the sternum daggerlike. This may not be phylogenetically correct, but at present it is simple and practical.

Apodemes III not distinctly connecting with apodemes IV

Sternum IV flanged: *rufovestis*, *fulvipes*, *histrion*, *saccharis*.

Sternum IV daggerlike: *anacardivoros*, *toltecus*, *pedestris*.

Apodemes III complete and distinctly connecting with apodemes IV

Sternum IV daggerlike: *vagus*, *tigris*

Vespacarus rufovestis, new species

(Figs. 17-20, 101)

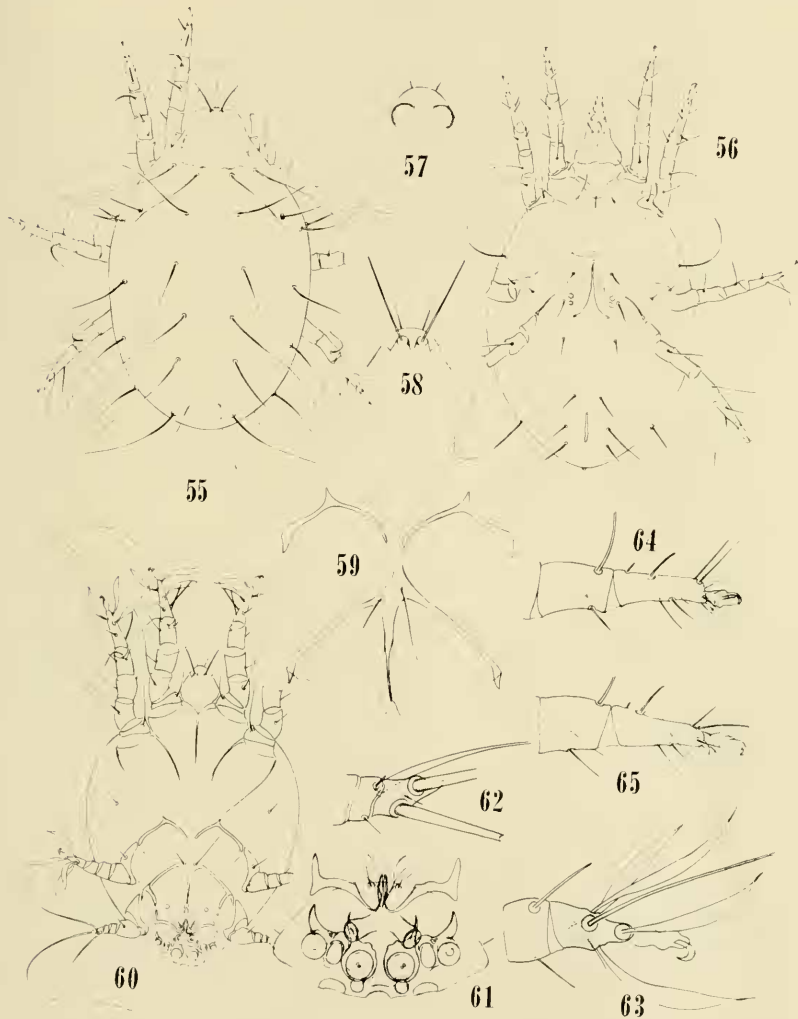
Female.—At present the female cannot be separated from the others in the genus. Length of nongravid female 586 μ .

Male.—Similar to female; length 360 μ .

Hypopus.—The hypopus belongs to the group of species in which the apodemes of coxae III are not connecting with those of coxae IV, and sternum IV is flanged; in this case there is apparently no remnant left of the connecting apodemes. Eyes set dorsally, separated by a distance less than the width of each, and projecting laterally over the edges of the propodosoma; anterior part of propodosoma gently rounded; gnathosomal setae as figured, the tiny lateral setae difficult to see, the anterior setae of the propodosoma of medium length. Apodemes III distinctly delineated medially; anterior junction of apodemes IV well delineated, split, approaching apodemes III; apodemes IV slightly curved, forming only slightly more than a 45 degree angle with each other; sternum barely reaching past posterior ends of apodemes IV, broad, flattened distally. Tarsus IV with two large and one weaker whiplike setae and the usual small spinelike seta; tibia IV with small spinelike seta, but only the base is left of the rodlike sensory seta which is missing. Tarsus III with the usual four large lanceolate setae, one long whiplike seta, and one short, small, simple, spinelike seta; tibia III with both sensory and tactile setae of medium length and equal. Length 255 μ .

The hypopus is distinctive in that the sensory and tactile setae of tibia III are of equal length, and the sensory seta of tibia IV is missing.

The holotype hypopus, U. S. National Museum No. 2572, and one paratype hypopus were collected in Washington, D. C., by K. V.



Vespacarus fulvipes, new species. Fig. 55, dorsal view of female; fig. 56, ventral view of female; fig. 57, dorsal view of anterior part of propodosoma of hypopus; fig. 58, ventral view of same region; fig. 59, coxal apodemes III and IV of hypopus; fig. 60, ventral view of hypopus; fig. 61, suctorial plate of hypopus; fig. 62, tibia and tarsus IV of hypopus; fig. 63, tibia and tarsus III of hypopus; fig. 64, tibia and tarsus I of female; fig. 65, tibia and tarsus I of male.

Krombein, from the acarinarium of the wasp *Stenodynerus (Paraneistrocerus) fulvipes rufocervis*, Lake Placid, Florida, February 17, 1958; two other paratype hypopi were collected from the same host and locality July 25, 1958. Male and female adults were from the same hosts and localities.

Vespacarus fulvipes, new species

(Figs. 55-65)

Female.—The female is similar to the others in the genus, with all dorsal body setae long and slender and of about equal length, as figured; the third pair of dorso-hysterosomals longer than others. Ventral apodemes as figured; genital setae short, simple; ventral setae slightly shorter, and two to three times as long as genital setae. Leg setation simple, as figured. Length 660 μ .

Male.—Similar to female. Length 319 μ

Hypopus.—The hypopus belongs to the species group in which the inner sections of apodemes of coxae III are incomplete, and sternum IV is flanged. The anterior part of the propodosoma is gently rounded; eyes are dorso-lateral, separated by a distance less than the width of each. Apodemes III thin but well delineated; anterior central portion of apodemes IV indistinctly connecting with apodemes III; apodemes IV thin, slightly curved, forming slightly more than a 45-degree angle with each other; sternum broadly flanged, reaching a short distance past the posterior ends of apodemes IV. Tarsus IV with the usual three strong whip-like seta and small spinelike seta; tibia IV with a short rodlike seta and whiplike seta of equal length. Tarsus III with the empodial claw, the usual lanceolate, whiplike, and spinelike setae; tibia III with the rodlike sensory seta about one-third longer than the spinelike tactile setae. Length 274 μ

The hypopus is distinctive in the shape of the propodosoma and the location of the eyes.

This species was collected in Washington, D. C., by K. V. Krombein from *Stenodynerus (Paraneistrocerus) fulvipes fulvipes* (Sauss.) from Kill Devil Hills, North Carolina, as follows: The holotype hypopus, U. S. National Museum No. 2573, and 56 paratype hypopi were collected from the acarinarium of a wasp August 11, 1955. Adults and nymphs were collected from nests on July 4 and 11, August 2, 3, 4, 6, and 12 in 1955, and on April 30, June 1, and 6, and October 10 in 1956.

Vespacarus histrio, new species

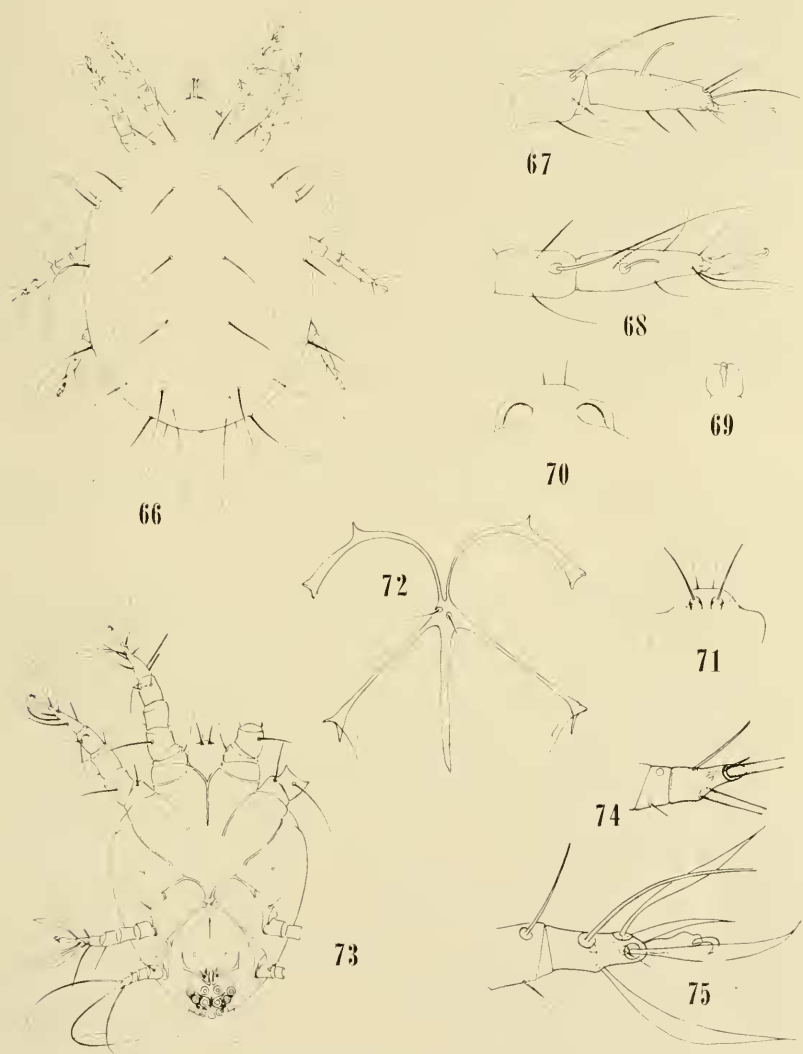
(Figs. 76-83, 112)

Female.—Body large, baglike; all dorsal setae long, slender, whiplike, of about equal length. Propodosomal shield about as wide as distance between outer propodosomal setae. Venter without distinguishing characters. Length 530 μ .

Male.—Similar to female, except that dorsal setae, with the exception of the anterior propodosomals, are strong, whiplike; anterior propodosomals slender, and at the most, only about one-half as long as others. Length 400 μ

Hypopus.—Belongs to the group of species in which apodemes III are not contiguous, and sternum IV is flanged. Anterior part of propodosoma triangular, setae typical; gnathosomal setae typical; eyes less than eye width apart. Apodemes III strong, well delineated medially; junction of apodemes IV projecting only slightly anteriorly, the two arms connecting apodemes III and IV barely visible;

apodemes IV broadly rounded; sternum broadly flanged, reaching only a short distance past posterior ends of apodemes IV. Tarsus IV pointed distally, with the usual three long, whiplike setae and short spinelike seta; tibia IV with a short



Vespacarus tigris, new species. Fig. 66, dorsal view of female; fig. 67, tibia and tarsus I of female; fig. 68, tibia and tarsus I of male; fig. 69, empodial claw; fig. 70, dorsal view of anterior region of propodosoma of hypopus; fig. 71, ventral view of same region; fig. 72, coxal apodemes III and IV of hypopus; fig. 73, ventral view of hypopus; fig. 74, tibia and tarsus IV of hypopus; fig. 75, tibia and tarsus III of hypopus.

tactile seta, and the rodlike seta consisting of a small protubrance. Tarsus III with the usual setae; tibia III with rodlike and sensory seta and tactile seta subequal, of medium length. Length 255 μ .

The hypopus is distinctive in the shape of the propodosoma, and in the small size of the rodlike sensory seta on tibia IV.

The holotype hypopus, U. S. National Museum No. 2574, and thirteen paratype hypopi was collected in Washington, D. C., by K. V. Krombein from the acarinarium of *Stenodynerus* (*Parancistrocerus*) *histrio* (Lep.) from Kill Devil Hills, North Carolina, July 24, 1955. Males and females were collected from nests, brought from Kill Devil Hills, at Washington, D. C., as follows: July, 1954; August 2, 1955; September 23, 1955; August 14, September 10, and October 10, 1956.

An interesting series of *histrio* hypopi was collected in Washington, D. C., from the acarinarium of *Stenodynerus* (*Parancistrocerus*) *fulvipes fulvipes*, Kill Devil Hills, North Carolina, February 18, 1959. Their presence on two species of wasps is possibly due to the overlapping of the wasps ranges and the similar biology of the wasps.

Krombein (1955A) has published a brief note on the biology of this mite and its host wasp.

Vespacarus saecularis, new species

(Figs. 21-24, 102, 118)

Female.—The female appears similar to the others with long, slender whiplike setae; the body is baglike, and indistinguishable from the others in this group. Length 666 μ .

Male.—Similar to the female. Length 426 μ .

Hypopus.—The hypopus belongs to those species in which apodemes III are incomplete, and sternum IV is flanged. The anterior part of the propodosoma sharply pointed, eyes set dorso-laterally and slightly less than eye width apart. Gnathosomal setae typical for the group. Apodemes of coxae III are incomplete, not meeting those of coxae IV; coxal IV apodemes broadly rounded, far removed from apodemes III; apodemes III and IV only faintly connected; sternum broad, flattened, and projecting past posterior ends of apodemes IV. Tarsus IV with the three large whiplike setae and a very small spinelike seta; tibia IV with a short rodlike sensory seta and a tactile seta of medium length. Tarsus III typical; tibia III with tactile and sensory setae subequal, of medium length. Length 255 μ .

The hypopus is distinctive in having broadly rounded coxal IV apodemes and a sharp propodosoma.

All specimens were collected in Washington, D. C., by K. V. Krombein from nests of *Stenodynerus* (*Parancistrocerus*) *saccularis rufulus* Bobart, from Lake Placid, Florida.

The holotype, U. S. National Museum No. 2575, and 121 paratype hypopi were collected February 17, 1958. Twenty-eight males and 59 females were collected from the same habitat at the same time.

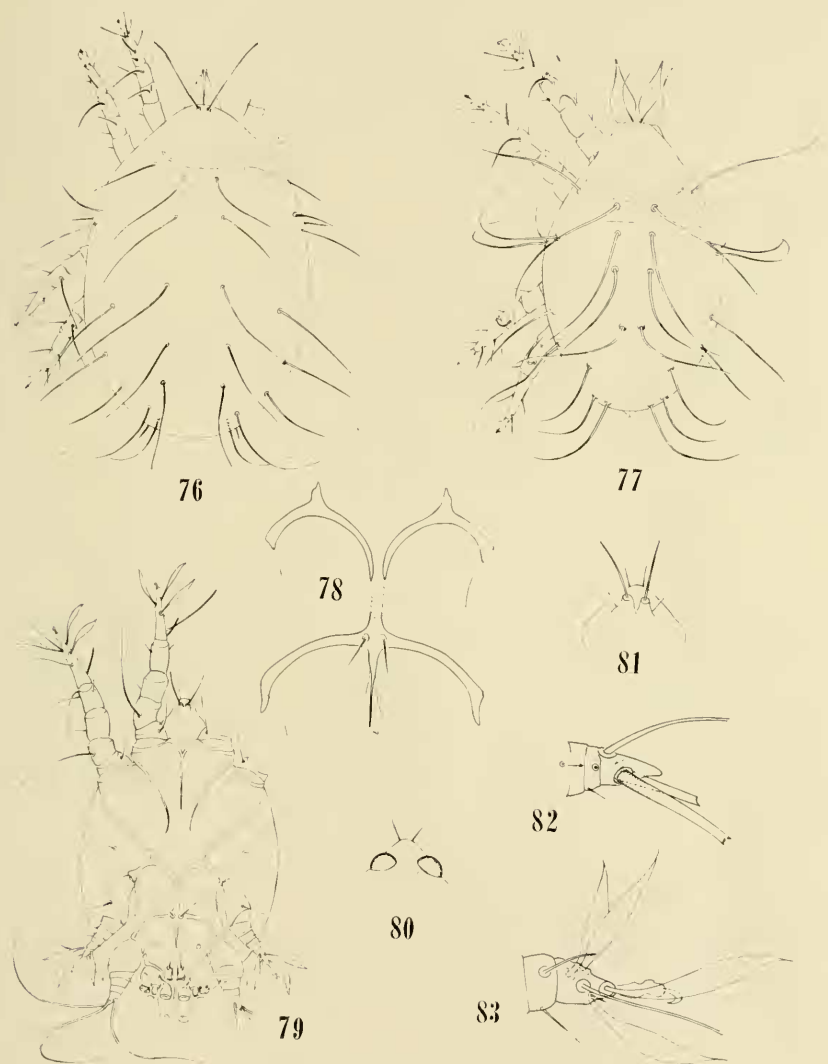
Vespacarus anacardivorus, new species

(Figs. 90-95, 115)

Female.—The female is very similar to the others in the genus. All dorsal setae are long, slender, whiplike; the anterior propodosomals are long, but only about

two thirds as long as the other propodosomals. The rest of the body setation is not distinctive. Leg setation is simple. Length 560 μ .

Male.—Similar to female. Length 530 μ .



Vespacarus histrio, new species. Fig. 76, dorsal view of female; fig. 77, dorsal view of male; fig. 78, coxal apodemes III and IV of hypopus; fig. 79, ventral view of hypopus; fig. 80, dorsal view of anterior part of propodosoma of hypopus; fig. 81, ventral view of same region; fig. 82, tibia and tarsus IV of hypopus; fig. 83, tibia and tarsus III of hypopus.

Hypopus.—The hypopus belongs to that group in which the apodemes of coxae III are incomplete and sternum IV is daggerlike. The eyes are set less than eye width apart; the propodosoma broadly rounded anteriorly; gnathosomal setae typical for the group. Apodemes III thin, the medial arms indistinct but connected with apodemes IV by lightly sclerotized arms; apodemes IV thin, slightly curved, forming more than a 45 degree angle with each other; sternum slender, abruptly narrowing just behind junction of apodemes IV and reaching to level of posterior arms of apodemes IV. Suctorial plate as figured. Tarsus IV with a large median seta, a slightly smaller lateral seta, and a relatively slender posterior lateral seta, as well as the usual simple spinelike seta; tibia IV possesses the short simple spinelike tactile seta, but the sensory seta consists of a small protuberance. Tarsus III with typical setation. Length 230 μ .

The hypopus is characterized by the faintness of the apodemes of coxae III medially, and by the closely set eyes.

The holotype hypopus, U. S. National Museum No. 2576, was collected in Washington, D. C., by K. V. Krombein from the acarinarium of *Stenodynerus* (*Parancistroccrus*) *perennis anacardivora* (Roh.), Paradise Key, Everglades National Park, Florida, April, 1954. Four females and two hypopi (paratypes) were collected from the cell of this wasp April 19-23, 1954.

Some brief notes have been published on the biology of this mite and its host wasp (Krombein, 1955B).

Vespacarus toltecus, new species

(Figs. 84-89, 116)

Male and female.—Not known.

Hypopus.—The hypopus belongs to the group with the incomplete coxal III apodemes and daggerlike sternum IV. The eyes are set on an elongate propodosomal projection, being separated by less than their width. Gnathosomal setae are normal. Ventral apodemes as figured, those of coxae III not meeting medially and barely discernible as they turn posteriorly to meet apodemes IV. Apodemes IV rounded, almost forming a circle. Suctorial plate as figured. Tibia IV with a short sensory seta and a tactile seta of medium length; tarsus IV with three large whiplike setae and a small slender spinelike seta. Tibia III with sensory rodlike seta longer than tactile seta; tarsus III typical. Length 242 μ .

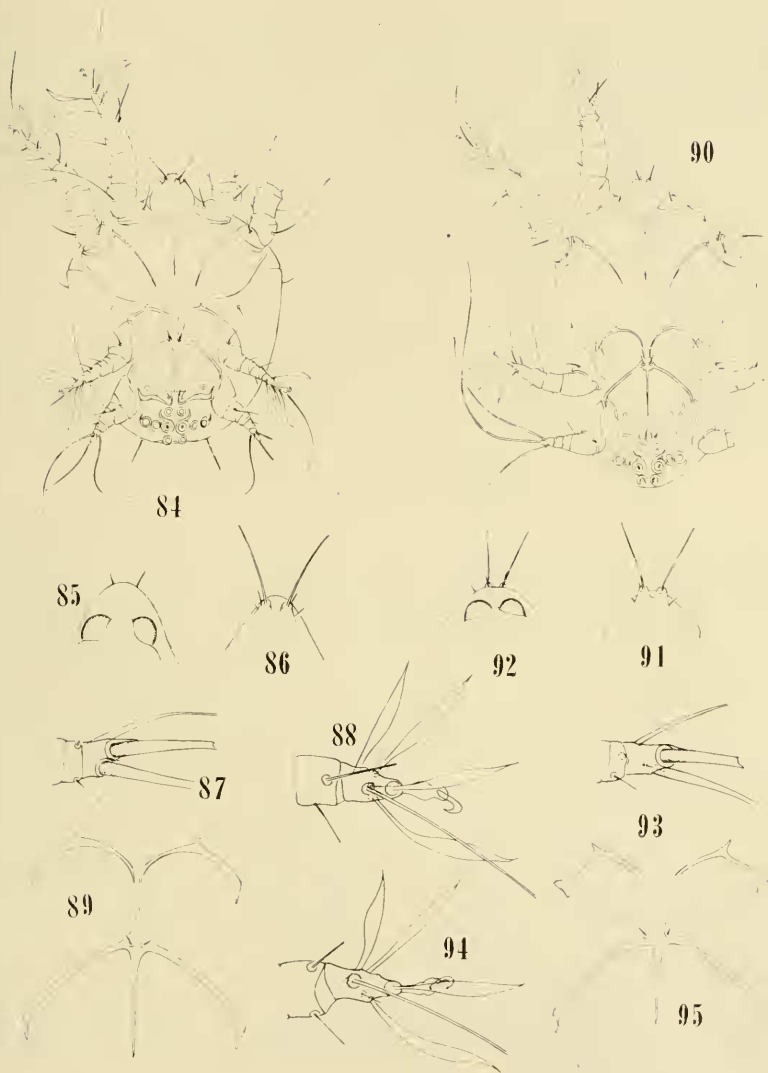
The hypopus is distinctive in having closely set eyes on an elongate anterior projection of the propodosoma, and in that tibia IV has a short rodlike sensory seta.

The holotype hypopus, U. S. National Museum No. 2577, and 7 paratype hypopi were collected in Washington, D. C., by K. V. Krombein from *Stenodynerus* (*Parancistroccrus*) *toltecus* (Sauss.), Chisos Mts., Brewster County, Texas, June 10-12, 1908 (Mitchell and Cushman, colrs.).

Vespacarus pedestris, new species

(Figs. 25-28, 104, 117)

Female.—The female differs very little from others with long, slender, whiplike setae of about equal length; the anterior propodosomals are long but only about two-thirds as long as the others. Leg setae are typical. Length 613 μ .



Vespacarus toltecus, new species. Fig. 84, ventral view of hypopus; fig. 85, dorsal view of anterior part of propodosoma of hypopus; fig. 86, ventral view of same region; fig. 87, tibia and tarsus IV of hypopus; fig. 88, tibia and tarsus III of hypopus; fig. 89, coxal apodemes III and IV of hypopus. *Vespacarus anacardivorus*, new species. Fig. 90, ventral view of hypopus; fig. 91, ventral view of anterior part of propodosoma of hypopus; fig. 92, dorsal view of same region; fig. 93, tibia and tarsus IV of hypopus; fig. 94, tibia and tarsus III of hypopus; fig. 95, coxal apodemes III and IV of hypopus.

Male.—Not known.

Hypopus.—The hypopus belongs to the group with incomplete coxal III apodemes and a daggerlike sternum IV. The eyes are less than eye width apart; the anterior propodosomal margins form less than a 45 degree angle; the gnathosomal setae are typical for the genus. Coxal IV apodemes complete and forming a half circle across venter of the body, with two well delineated prongs pointing anteriorly; sternum tapering, well surpassing posterior ends of apodemes IV. Tarsus IV with three strong whiplike setae and one small simple spinelike seta; tibia IV with a short tactile seta and a short sensory seta. Tibia III has a short to medium length tactile seta; the sensory seta is about a third longer; tarsus III with typical setation. Length 230 μ .

The hypopus is distinctive in having closely set eyes and a sharp propodosoma.

The holotype hypopus, U. S. National Museum No. 2578, and 45 paratype hypopi were collected in Washington, D. C., by K. V. Krombein from *Stenodynerus (P.) pedestris pedestris* (Sauss.), Derby, New York, July 1955. Five females and one hypopus were collected from a nest from the same locality in August, 1955.

Vespacarus vagus, new species

(Figs. 29-32, 103, 113)

Male and females.—Not known.

Hypopus.—The hypopus belongs to those species in which the apodemes of coxae III and IV meet medially. All dorsal body setae are short and of equal length except for the outer propodosomals which are about two times longer. The eyes are terminal, prominent, and less than eye width apart. The lack of the short gnathosomal setae is distinctive (they are also missing in *Monobiacarus*). The apodemes of coxae III are slender, rounded, not meeting medially, and only lightly sclerotized medially where they meet apodemes IV; coxal apodemes IV are gently rounded and form an arch of more than 45 degrees and less than 60 degrees; the sternum of coxae IV is short, tapering, barely surpassing posterior ends of apodemes IV. Tarsus IV with four strong whiplike setae, and one short spinelike seta; tibia IV with the short spinelike seta and a very short rodlike sensory set. Tarsus III with the four usual large lanceolate setae, one long whiplike seta, and a short spinelike seta; tibia III with a medium length rodlike sensory seta and a shorter tactile seta. Length 217 μ .

The hypopus is characterized by the closely set terminal eyes, and the missing gnathosomal setae.

The holotype hypopus, U. S. National Museum No. 2579, and 46 paratype hypopi were collected in Washington, D. C., by K. V. Krombein, March, 1958, from *Stenodynerus (P.) vagus vagus* (Sauss.), Toronto, Canada, August 16, 1896 (R. J. Crew, colr.).

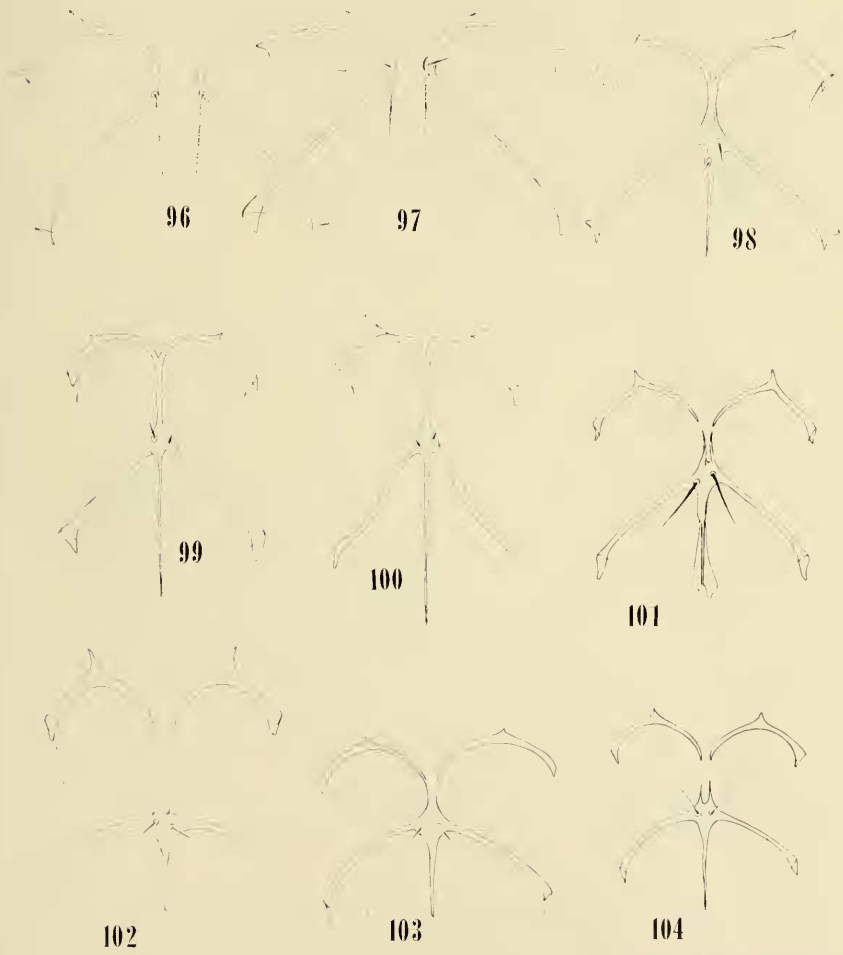
Vespacarus tigris, new species

(Figs. 66-75, 119)

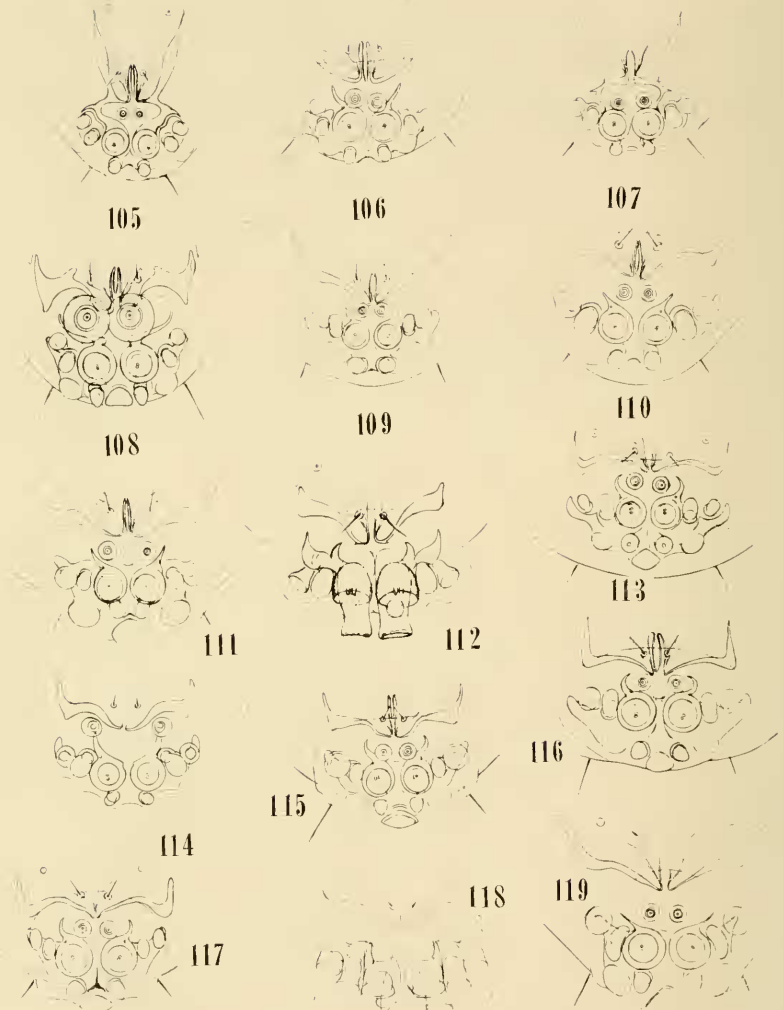
Female.—The body is baglike, with long slender setae of about equal length except for the pair of short anterior propodosomals, which are about one-third as long as the others; the propodosomal shield is small, not much wider than distance between inner pair of propodosomal setae. Length 813 μ .

Male.—Not known.

Hypopus.—The hypopus belongs to the group in which apodemes of coxae III and IV meet medially. All dorsal body setae are short and of equal length. Anterior part of propodosoma broadly rounded, with setae of medium length; gnathosomal setae typical; eyes dorsal, well separated by width of eye. Apodemes of coxae III well sclerotized and connecting to apodemes of coxae IV; apodemes III and IV thin, apodemes IV straight, forming an angle of about 45 degrees; sternum not



Coxal apodemes III and IV of hypopi. Fig. 96, *Monobiacarus insularis*, new species; fig. 97, *Monobiacarus funebris*, new species; fig. 98, *Ensliniella aegyptiana*, new species; fig. 99, *Ensliniella königi*, new species; fig. 100, *Ensliniella parasitica* Vitzthum; fig. 101, *Vesparacus rufovestis*, new species; fig. 102, *Vesparacus saecularis*, new species; fig. 103, *Vesparacus vagus*, new species; fig. 104, *Vesparacus pedestris*, new species.



Suetorial plates of hypopi. Fig. 105, *Ensliniella parasitica* Vitzthum; fig. 106, *Ensliniella aegyptiana*, new species; fig. 107, *Ensliniella königi*, new species; fig. 108, *Kennethiella trisetosa* (Cooreman); fig. 109, *Monobiacarus funebris*, new species; fig. 110, *Monobiacarus insularis*, new species; fig. 111, *Monobiacarus quadridens*, new species; fig. 112, *Vespacarus histrio*, new species; fig. 113, *Vespacarus vagus*, new species; fig. 114, *Vespacarus rufocostis*, new species; fig. 115, *Vespacarus anacardivorus*, new species; fig. 116, *Vespacarus toltecus*, new species; fig. 117, *Vespacarus pedestris*, new species; fig. 118, *Vespacarus sacularis*, new species; fig. 119, *Vespacarus tigris*, new species.

tapering, daggerlike, well surpassing posterior ends of apodemes IV. Tarsus IV distinctive in that the small spinelike seta is strong; tibia IV has only the small tactile seta and the remnants of the base of the rodlike sensory seta. Tarsus III with the usual setae; tibia III with the sensory seta more than twice as long as the tactile seta. Length 261 μ .

The hypopus is characterized by having a broadly rounded propodosoma, the eyes being separated by eye width, and the strong sternum IV.

The holotype hypopus, U. S. National Museum No. 2580, and 25 paratype hypopi were collected by K. V. Krombein on August 8, 1954, from nests of *Ancistrocerus tigris tigris* (Sauss.) from Arlington, Virginia. Seven hypopi and 4 females were collected from the same nests August 14, 1954. Sixteen hypopi and 3 females were collected in July, 1950 from nest material from Derby, New York. Two females were collected May 1, 1957 from nests of wasps collected by Kill Devil Hills, North Carolina. All collections were made in Washington, D. C.

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