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Species of *Pimeliaphilus* (Acari: Pterygosomidae) Attacking Insects, with Particular Reference to the Species Parasitizing Triatominae (Hemiptera: Reduviidae)

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Seven species of mites of the genus *Pimeliaphilus* from the United States and Mexico are described as new: *P. gloriosus, P. sanguisugae, P. plumifer, P. calimesae, P. peninsularis, P. andersoni,* and *P. joshuae.* The host of *P. joshuae* is unknown, but all the other new species parasitize kissing bugs (Reduviidae: Triatominae) found in rodent nests, human habitations, or poultry shelters. In addition to the seven new species described here, *P. triatomae* is reviewed by using specimens sent from South America; *P. cunliffei,* by a careful analysis of the data in two earlier papers; and *P. podapolipophagus,* by study of a "cotype" loaned to the authors. The ten species above are compared in a detailed tabular key which sets forth the principal morphological characters of value in differentiating between species. Biological notes are given for *P. gloriosus,* which can be a serious threat to laboratory colonies of bugs of the Triatoma Protracta Complex.

Index to *Pimeliaphilus* Species

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INTRODUCTION

AT PRESENT, three species of mites parasitic upon insects have been ascribed to the genus *Pimeliaphilus,* namely, *P. podapolipophagus* Trägårdh 1905[3] (on *Pimelia* sp., Coleoptera, Tenebrionidae); *P. triatomae* Cunliffe 1952 (on *Triatoma infestans* [Klug]); and *P. cunliffei* Jack 1961 (on cockroaches). *P. isometri* Cunliffe 1949 and *P. rapax* Beer 1960 are parasitic on scorpions. Several other species have been placed here at one time or another, but have been referred subsequently to the genus *Hirstiella* Berlese 1920.

When abundant, *Pimeliaphilus cunliffei* is capable of killing roaches in laboratory colonies within a few hours; moreover, roaches seem to defend themselves against attack by these mites, and will dislodge the mites or even swallow them (Cunliffe, 1952). Undiano and Shictong (1963) described the difficulties encountered in rearing *Triatoma* in the presence of *P. triatomae,* and suggested the possibility of using that mite in the biological control of vectors of *Trypanosoma cruzi* Chagas. Similarly, *P. gloriosus* n. sp. weakens and kills bugs of the family Reduviidae, and can be a serious problem in maintaining laboratory colonies of these insects. The possibility that species of *Pimeliaphilus* may transmit viral or rickettsial diseases of their hosts should be seriously considered and investigated. It has been shown that the blood protozoan *Hepatozoon sauromali* Lewis and Wagner 1964 gains entry to host lizards when the latter ingest infected pterygosomid mites belonging to the genus *Hirstiella* (Newell and Ryckman, 1964).

Initially, our interest in the pterygosomid mites attacking reduviids arose from difficulties in rearing these insects

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[3] See "Literature Cited" for citations, referred to in the text by author and date.

in the laboratory. Subsequent studies have indicated the existence of an extensive complex of species associated with reduviids in the field. The present paper describes seven new forms which have been collected in the United States and Mexico. In addition, a summary of the principal morphological variants found in the genus is given, along with a tabular key to the known species. (See pp. 414–417.)

The systematics of the genus is still unclear because of the lack of adequate collecting. At one level, *Pimeliaphilus podapolipophagus, P. andersoni, P. triatomae, P. gloriosus, P. joshuae,* and *P. plumifer* are unmistakably distinct from each other. At another level, *P. plumifer, P. calimesae,* and *P. peninsularis* form a complex of forms which are evidently closely related and may eventually be considered subspecies. Finally, within *P. plumifer,* which is the most widely collected form, variations are found from one locality to another. However, larger collections and a more detailed study of individual variations must be made before the significance of these local differences can be estimated.

Host specificity does not appear to be very marked, and is doubtless in large part a function of host ecology. As will be discussed later, the natural habitats of the new species described here are the nests of various wild rodents. Dispersal from one nest to another is probably effected mainly by the flight of the host insects. More information on this will come from studies on the biology of the hosts, now being carried out by other investigators. *Pimeliaphilus plumifer* and *P. andersoni* have both been collected on more than one host in widely separated localities. The host of *P. joshuae* is unknown, this species having been taken in the course of general collections from debris at the base of decaying joshua trees (*Yucca brevifolia* Engelm.). From the fact that considerable collecting of Triatominae has been carried out in and near the type locality of this species without establishing a host correlation, it would appear that *P. joshuae* parasitizes hosts other than kissing bugs.

In the following descriptive accounts, *Pimeliaphilus gloriosus* is described in considerable detail, while other species are described largely by pointing out their principal differences from *P. gloriosus. P. peninsularis* and *P. calimesae,* however, are described by comparison with *P. plumifer,* to which they are apparently most closely related. All species are compared in detail with each other in the tabular key (table 2), which contains the morphological characteristics showing variants that have been found most useful in differentiating between species.

Most of the material used in the present study was cleared in pepsin and mounted in Hyrax for microscopic examination. In the descriptions of species, the positions of particular setae or other structures are indicated by the decimal system of notation introduced by Newell (1957, p. 398). In this system, d = dorsal, a = anterior, pv = posteroventral, etc. The relative linear position of the structure on a segment of the leg or palp is given as a decimal in which 0.00 represents the proximal end of the segment and 1.00 represents the distal end. Means are given in parentheses, and superscripts indicate the number of individual measurements made in arriving at the ranges and the means. Thus, "Tarsus I with a basal solenidion at .27–.31d(.29)^5..." means that one tarsus on each of five individuals was measured, and the basal solenidion was found to lie dorsally between .27 and .31, with the mean position at .29. The terms dorsal, ventral, anterior, and posterior are utilized to express position with relationship to the longitudinal axis of the appendages. Lateral and medial should not be employed in reference to the legs, since the morphological meaning of these terms on I and II is exactly reversed on III and IV. In applying the terms *a* and *p,* the legs should be visualized as projecting at right angles to the longitudinal axis of the idiosoma. For the sake of morphological consistency, the same orientation should be visualized in the case of the pedipalps, despite the seeming incongruity of the pedipalps of a mite projecting at right angles to the body.

When the decimal system of positional notations is applied to the scutum, the anteriormost point on the midline is 0.00, regardless of whether the anterior margin is convex or concave. In some species of *Pimeliaphilus,* the first or even the second pair of scutal setae is anterior to this point. In such cases, the anterior displacement is expressed as a negative decimal fraction of the length of the scutum at the midline. For example, in *P. gloriosus* the first pair of scutal setae lies at a level anterior to the anterior midpoint of the scutum, and approximately one-sixth of the midline length of the scutum anterior to that point. Accordingly, the level of the first pair of setae is given as –.14 to –.19 (–.16)[5]. The choice of the anteromedian point as the standard of reference avoids certain inconsistencies and difficulties of measurement which would be encountered if the anterolateral corners of the scutum were to be taken as the anterior limit. The choice of this point of reference is based on experience, not only in the Pterygosomidae but in other families as well.

TAXONOMIC ACCOUNTS OF SPECIES

Pimeliaphilus gloriosus n. sp.

Female. Idiosoma of five smallest individuals 392–444μ long, 331–383μ wide, L/W* 1.13–1.24; five largest individuals 661–722μ long, 583–626μ wide, L/W 1.13–1.19. Averages of ten individuals $560 \times 483\mu$, L/W 1.17. Young females (figs. 1, 2) have pronounced lateral lobes on the podosoma between II and III, and three pairs of lobes posteriorly on the opisthosoma, lateral to the anal papilla. With progressive increase in size, these lobes become relatively reduced, especially those at the posterior end of the body (figs. 11, 12). Scutum in flattened individuals 104–116 (111μ) long, L/W .83–.96 (.88)[5]. Anterior margin of scutum (fig. 3) deeply concave, so that the first pair of scutal setae lies at –.14 to –.19 (–.16); the second pair at –.02 to –.06 (–.04); and the third pair at .14 to .20 (.17)[5]. The third scutal setae are 116–131 (124μ)[8] long. Cuticle of the scutum with faint, somewhat irregular striae. Membranous cuticle of dorsum heavily striated. Twelve pairs (thirteen in distended individuals) of dorsal and marginal setae, excluding the three pairs on the anal sclerites. Except for those of the scutum and the ocular plate, each seta arises from a minute sclerite. Dorsal setae of anal papilla elaborately barbed, arboriform (hence the specific name), as shown in figure 7.

Coxal setae numbering 2-2-3-0. Median seta of coxa II smooth, slender, but lateral seta stiff, peripectinate. A single pair of ventral intercoxal setae between IV, and posterior to that are six pairs of ventral or marginal setae, including those around the genital opening. These ventral setae become progressively more ornate toward the posterior end of the body. Dorsal surface of gnathosoma sharply sculptured to form a shallow trough in which the peritremes lie. Peritremes forming a very flat "W," .66–.76 (.70)[5], as wide as base of gnathosoma (fig. 4). Rostrum convex dorsally. Near the tip, the rostrum has an expanded, hemispherical, ventral flange,

* The symbol "L/W" refers to the ratio of length to width, usually averaged from a series of specimens examined. This is based on measurements in microns (μ).

and just distal to this is a pair of keel-like lamellar protuberances oriented diagonally to the axis of the rostrum (fig. 10). When seen end-on, these lamellae have the appearance of a sharp point (fig. 9, x), but when the angle of orientation is rotated about 90° within the horizontal plane of the rostrum, the keel-like form of these lamellae is seen (fig. 9, y). Rostrum with a pair of smooth, slender, ventral setae slightly distal to the insertions of the palpi, but with no other setae. Tip of rostrum with a distinct velum distal and dorsal to the rostral flange, marked dorsally with prominent, transverse, parallel striae. Chelicerae very slender, concave ventrally, tarsus of chelicerae sharply pointed (figs. 20, 21).

Trochanter of pedipalpi ringlike but complete; femur with a curved, penicillate, peripectinate seta dorsally, 39–45 $(42\mu)^5$ long; patella with a long, tapering, smooth seta (fig. 19). Anterior aspect of femur of palp with a few parallel striae which have a dorsoventral orientation. Tibia with a relatively long, heavy odontus (fig. 5, *od*), extending well beyond the end of the tarsus, and two other normal setae, the one on the anterior aspect only about one-half as long as the one on the posterior aspect. The odontus tapers uniformly to a rather sharp, curved point, and there is no sign of bifurcation. Tarsus (fig. 17) a short cylinder, about as broad as long; a solenidion at .5*p*, directly distal to which is a slender eupathid. Tarsus with five additional normal setae, one or two of which are smooth, the others with one to five barbs. Between the eupathid and the solenidion is a short peg, less than 1μ in length, and occupying a common alveolar field with the eupathid and the most distiventral normal seta (fig. 18).

Legs I and IV with femur subdivided by a cincture into basifemur and telofemur (fig. 24); II and III with no trace of a subdivision; patella I with a sharp vestigial seta at .89*d*. The taper of the vestigial seta is unusual; the diameter of the shaft is relatively uniform to about the middle of the seta, where it tapers abruptly to a very fine point. Tibia I with bothridion at .34–.37 $(.35)^5$, the shaft of which is barbed, but more slender than that of the normal setae. Tibia IV 69–71 $(70\mu)^8$ long. Tarsus I (fig. 22) with a basal solenidion 26–$28\mu^2$ long at .27–.31*d* $(.29)^5$, a more distal solenidion and companion seta at .53–.56 $(.55)^5$, a pair of dorsal eupathidia at .84–.90 $(.89)^5$, and a second pair of eupathidia directly ventral to these. The distal solenidion appears minutely fenestrated, and is about 3.00–4.54 $(3.58)^5$ times as long as the companion seta. Directly ventral to the dorsal pair of eupathidia is a pair of setae which are flattened and frondlike in the distal one-half (clearly visible only in dorsal or ventral view). Tarsus II (fig. 26) with a short $(7–8\mu)^3$ solenidion at .17–.22 $(.20)^5$, and no typical eupathidia. Tibia III with a bothridion at .21–.26 $(.23)^5$, and tibia IV with a bothridion at .27–.31 $(.29)^5$, both of these similar to that on tibia I. Tarsus III with a short $(5\mu)^1$ solenidion at .17–.22 $(.19)^5$. Two lateral claws on each tarsus. From the median side of each claw arise one to four tenent hairs, each with an asymmetrically expanded tip; from the lateral side of each claw arise one to three (fig. 23) similar but much longer tenent hairs. There appears to be no consistent difference between tarsi in the number of tenent hairs; rather, the apparent number seems to vary according to the degree of adhesion of the individual tenent hairs, or according to random variation in real numbers of them. Other details of chaetotaxy of legs appear in table 1 and in the tabular key (table 2, p. 417).

Male. Idiosoma 288–340μ long, 169–198μ wide, L/W 1.63–1.80; averages of four males 310μ long, 184μ wide, L/W 1.70. Scutum urn-shaped, truncate anteriorly, with four pairs of setae within the plate (figs. 30, 32). Scutum not sharply delimited from surrounding

TABLE 1
DISTRIBUTION OF SETAE ON LEGS OF *PIMELIAPHILUS GLORIOSUS* n. sp.*

Sex and leg number	Trochanter	Femur	Patella		Tibia		Tarsus				
	n	n	n	v	n	b	n	s	e	c	f
Female I	1	1 + 5, *4*	5	1	4	1	9	2	4	1	0
II	1	4	5	0	5	0	10	1	0	0	0
III	1	3	3	0	4	1	10, *9*	1	0	0	0
IV	1	0 + 3	3	0	4	1	10	0	0	0	0
Male I	1	5	5	1	4	1	9	2	4	1	0
IV	0	2	3	0	4	1	10	0	0	0	0

* b = bothridion; c = companion seta; e = eupathid; f = famulus; n = normal seta; s = solenidion; v = vestigial seta; + = femur divided; *4* or *9* = exceptional variant.

cuticle, but marked by a change in coarseness and/or direction of the striae. Each ocular plate with one peripectinate seta as long as most of the other dorsal setae. Four pairs of scutal setae and four pairs of setae on the anal papilla, plus eight other pairs of dorsal and marginal setae. Posterior to the scutum are four sclerites, each bearing two setae. Each of the anterior sclerites may be lightly divided by faint striae crossing the plate obliquely between the two setae, but this is not a constant feature. Chaetotaxy of legs similar to that of female, except that femur I has only five setae, while femur IV has only two setae. All femora are undivided.

Type locality and host. Sola de Vega, Oaxaca, Mexico, on *Triatoma barberi* Usinger 1939, 1 August 1960; R. E. Ryckman, A. E. Ryckman, and C. P. Christianson. Holotype and two paratype females to be deposited in USNM, ten paratype females in AMNH, and nine paratype females in BM(NH).

Remarks. The type specimens were actually selected from a laboratory colony reared on *Triatoma protracta protracta* because these were in better condition and more numerous than the field-collected material. The latter consisted of only four adult females. One of these was keyed out in detail, and the values obtained fell within the ranges of those obtained from the type series in every case except character 25. (See table 2 on page 417.) In the individual measured, the distal solenidion of tarsus I was 53μ long, compared with the range of 47–51μ in the type series. However, the specimen was strongly compressed, and the solenidion was straight rather than curved as in normal specimens. Had this measurement been made in the usual manner, even this minor discrepancy might not have been observed. Therefore, there is no reason to feel that any of the morphological characteristics in this species had been altered by the conditions of culture over the few months the mites had been in the laboratory. (See biological notes, p. 418.)

Pimeliaphilus sanguisugae n. sp.

Female. Very similar to *Pimeliaphilus gloriosus,* to which it is probably most closely related. There are only two specimens in the type series, so a reliable comparison is not possible in all characters. Some of the more significant points of similarity are found in the broad form of the scutum (although it is not so broad as in *P. gloriosus*), the smoothness of the ventral setae of the gnathosoma and the median seta of coxa II, and the rather heavy sculpturing on the dorsal and lateral walls of the gnathosoma (figs. 35, 36). The arrangement of the ventral intercoxal and postcoxal setae is the same as in *P. gloriosus.* Appreciable differences are found in the much greater depth of the concavity of the anterior margin of the scutum in *P. gloriosus,* the relative positions of the levels of the scutal setae (see especially characters 30, 31, 34 in table 2, page 417), the presence of a seta on coxa III (compared with its consistent absence in *P. gloriosus*), the greater number of dorsal and marginal setae, the longer setae of the legs (characters 20, 21). It is doubtful that study of more extensive collections would significantly alter these differences, and the two forms are considered to be distinct.

Type locality and host. Four miles east of Huntingburg, Indiana, holotype female and one paratype female on *Triatoma sanguisuga* (Le Conte) 1855, 19 September 1964; Robert C. Anderson. Holotype female to be deposited in USNM.

Pimeliaphilus plumifer n. sp.

Female. Similar to *Pimeliaphilus gloriosus* in general appearance, but differing in a number of characteristic details. Idiosoma in type series 470–587μ long, L/W 1.24–1.64^{5}. With fourteen pairs of dorsal and lateral setae, including those of the scutum, but excluding those of the anal papilla. Length of scutum along median line 133–141 (138μ)^{3}, L/W 1.36–1.45 (1.40)^{3}. Anterior margin of scutum (fig. 41) not so concave as in *P. gloriosus,* the first pair of setae at 0.00, second pair at .05–.07 (.06), third pair at .45–.49 (.47)^{3}. Cornea and accompanying seta partly separated by striae (fig. 40). Dorsal setae slightly longer than in *P. gloriosus,* the third pair of scutal setae measuring 148–161 (155μ)^{4}. Dorsal setae of anal papilla (fig. 39) slightly more slender than the corresponding setae in *P. gloriosus.*

Coxal setae 2-2-3-1 rather than 2-2-3-0 (fig. 44). Median seta of coxa II not smooth, but stiff, peripectinate, like the lateral seta. Ventral setae of gnathosoma and other ventral setae peripectinate throughout their length (hence the specific name). Dorsum of gnathosoma not angularly sculptured, but more smoothly rounded. Tibia IV 74–86 (84μ)^{4} long. Basal solenidion of tarsus I 30–32μ^{2} long. Other details as in *P. gloriosus.*

Male. Not known.

Type locality and host. Near Colossal Cave, about twenty-two miles southeast of Tucson, Arizona, holotype female and five paratype females on *Triatoma rubida* (Uhler) 1894, 14 July 1964; R. C. Anderson. Holotype female to be deposited in USNM.

Other collection data. Forms referable to this species have been collected at several points in Mexico and the southwestern United States. While slight differences in structural details have been noted, these do not appear to be great or consistent enough to warrant the establishment of separate taxa. More widely distributed collections are required before a critical study of variations occurring in this group of mites can be made.

Twelve miles south of Mojave, California, five females on *Paratriatoma hirsuta* Barber 1938 from nest of *Neotoma* sp., 10 July 1964; R. C. Anderson.

Colossal Cave, about thirty miles east of Tucson, Arizona, three females on *Triatoma protracta* (Uhler) 1894 from nest of *Neotoma* sp., 30 August 1964; R. C. Anderson.

Colossal Cave, Arizona, seventeen females on *Triatoma rubida,* 28 August 1964; R. C. Anderson.

Five miles west of Santa Rita Lodge, Madera Canyon, Pima County, Arizona, two females on *Triatoma rubida,* 15 July 1964; R. C. Anderson.

Five miles north of Madera Canyon, Pima County, Arizona, three females on *Triatoma protracta,* 28 August 1964; R. C. Anderson.

Five miles north of Madera Canyon,

Arizona, five females on *Triatoma rubida,* 28 August 1964; R. C. Anderson.

About 173 miles northwest of La Paz, Baja California, Mexico, one female from nest of *Neotoma* sp. (host either *Triatoma rubida* [Uhler] 1894 or *T. peninsularis* Usinger 1940), 29 July 1964; R. E. Ryckman and C. P. Christianson.

About eighteen miles southeast of Los Mochis, Sinaloa, Mexico, one female on *Triatoma rubida,* 13 July 1964; R. E. Ryckman and C. P. Christianson.

About 116 miles northwest of La Paz, Baja California, Mexico, one female on *Triatoma rubida,* 20 July 1964; R. E. Ryckman and C. P. Christianson.

Three miles north of Sonora–Sinaloa state line, Highway 15, Mexico, one female on *Triatoma rubida* from nest of *Neotoma* sp., 27 July 1964; R. E. Ryckman and C. P. Christianson.

Twenty-two miles south of La Paz, Baja California, Mexico, one female on *Triatoma rubida,* 24 July 1964; R. E. Ryckman and C. P. Christianson.

San Francisquito Bay, Baja California, Mexico, one female on *Paratriatoma hirsuta,* 23 June 1963; R. E. Ryckman and P. J. Williams.

Remarks. While most specimens are from *Triatoma rubida,* the species also has been collected on *T. protracta* and *Paratriatoma hirsuta.* The specimens from the latter host were not distinguishable from forms taken on *T. rubida.* This species is fairly constant throughout its known range: southern Baja California to south central Arizona. The tendency toward the development of penicillate setae on the ventral surface was noted in specimens from all localities. Principal variations appear to involve scutal indices and the lengths of individual setae, which differ slightly from data obtained in the type series.

Pimeliaphilus calimesae n. sp.

Female. Idiosoma 444–827(635μ)[7] long, L/W 1.40–1.57(1.48)[6]. Very similar in general appearance to *Pimeliaphilus plumifer* n. sp., with which it will be compared, but differing in the details listed below. The numbers in parentheses refer to the character numbers in the tabular key (table 2). Scutal setae 1 and 2 slightly more widely separated than in *P. plumifer* (character 34); dorsalmost setae of anal papilla more slender (character 9); ventral setae of gnathosoma (fig. 46) considerably less plumose, peripectinate basally, but smooth and tapering distally (character 4); peritremes narrower (character 18); form of peritremes more or less as in *P. gloriosus,* slightly bisinuate (fig. 47). Dorsal seta of femur of palp shorter (character 19); companion seta possibly somewhat longer, relative to distal solenidion, which is slightly shorter (character 25) than in *P. plumifer.*

Male. Not known.

Type locality and host. A mile and one-half east of Calimesa, Riverside County, California, holotype female, eighty-nine paratype females, and one paratype deutonymph on *Triatoma protracta protracta* (Uhler) 1894, July–October 1964; R. D. Sjogren. Holotype female to be deposited in USNM; one paratype female in AMNH.

Remarks. The differences between *Pimeliaphilus calimesae* and *P. plumifer* are not great, and further study will probably show them to intergrade somewhat, but ecological considerations lead the authors to believe that these two forms represent reasonably discrete populations. Eventually they may become regarded as subspecies, but until more is known of their distributions it is just as well to treat them as separate species. *P. plumifer* is also found on *Triatoma protracta,* but its distribution is more Sonoran in character. *T. pro-*

tracta protracta is found along the more humid western edge of the range of the species.

The excellent type series was collected by Robert D. Sjogren in connection with studies on the seasonal distribution of *Triatoma protracta* in the vicinity of Calimesa. In all, 398 bugs were collected, 250 were examined for the presence of mites, and 66 bore from 1 to 10 mites (26.4 per cent infested). The sex ratio of all the bugs was 228♂ : 170♀ (58:42), while that of the infested bugs was 42♂:24♀ (62:38). The infested male bugs bore an average of 1.2 mites, while the females bore 1.7 mites per individual. It appears that there are no marked sexual differences in the incidence of mite attack. It is interesting to note that all specimens in the type series (91 mites from 66 infested bugs) were females, one of which was a deutonymph. This would suggest that the males, if present, tend to remain in the nests of the rodents on which the bugs are parasitic, or that their survival on the female bugs outside the nest is considerably more limited than that of the females.

In 57 individuals, the point of attachment to the host was classified, with the following results: Head 21, thorax 23, abdomen 13. On the head, 12 were found at the base of the antennae, 7 near the eyes, and 2 on the proboscis. On the thorax, 10 were found on the thoracic wall proper, 9 on the legs, and 4 on the wings. Of those on the thoracic wall proper, 5 were found on the mesonotum alone. On the abdomen, 6 were dorsal and 7 ventral in position. The data show that the mites exercise little preference in attachment site, with the possible exception of the antennal bases, where 12 of the 57 mites were found. The chelicerae appear to be capable of piercing the host cuticle at nearly any point.

Pimeliaphilus peninsularis n. sp.

Female. Only one female has been measured thus far, owing to the scarcity of material, but a number of character variants are definitely distinct from those found in *Pimeliaphilus plumifer*, with which *P. peninsularis* is compared below. The numbers in parentheses refer to the characters in the tabular key on page 417.

Dorsalmost setae of anal papilla slightly more arboriform than in *P. plumifer* (character 9), ventral setae of gnathosoma slender and smooth (character 4), peritremes narrower (character 18), normal setae of legs and basal solenidion of tarsus I unusually short (characters 20, 21, 24), tibia IV also short (character 22).

Type locality and host. Forty-six miles northwest of La Paz, Baja California, Mexico, on *Triatoma peninsularis* (hence the specific name), from nest of *Neotoma* sp., 22 July 1964; R. E. Ryckman and C. P. Christianson. The material studied was reared on *T. protracta* in the laboratory. Holotype female to be deposited in USNM.

Remarks. *Pimeliaphilus peninsularis* is also similar to *P. calimesae* in a number of respects, but differs in the lengths of the setae indicated above (fig. 48). Also, the ventral setae of the gnathosoma are slender and smooth, while in *P. calimesae* they are thickened and slightly barbed in the basal portion. Considering the relative constancy of these characters in other species of the genus, and also taking into account the ecology and distributional characters, it appears likely that further study will substantiate the distinctiveness of *P. peninsularis*.

Pimeliaphilus andersoni n. sp.

Female. The holotype female had an idiosoma 592μ long, L/W 1.41. Median length of scutum 100μ, scutum broader than long, L/W .64, widest portion of scutum at level of third pair of setae. Anterior margin of scutum concave. First pair of setae at –.13, second pair at –.03, third pair at .21, all three pairs of setae relatively far anterior. Third pair of setae more widely separated than first or second (fig. 54). Dorsal and marginal setae numbering fourteen pairs, relatively long, the third pair of scutal setae 244μ long, compared with 116–131μ in *Pimeliaphilus gloriosus.* Dorsalmost setae of anal papilla (fig. 53) short penicillate-arboriform, not so broad as in *P. gloriosus.* The second and third pairs (ventral) of anal setae appear flattened or even bifid in the material available. However, this could not be checked carefully because of insufficient material for dissection. The bifid appearance is probably an artifact arising from the sharply linear arrangement of the barbs.

Coxal setal formula 2-2-3-0. Median and lateral setae of coxae II very nearly smooth, slender, tapering (fig. 57). Setae associated with dorsal and ventral surfaces of genitoanal area, as shown in figures 52 and 53, which were drawn from the Texas specimen. Setae of ventral surface of gnathosoma *proximal* to insertion of palpi, as seen in ventral view (fig. 49). Dorsal surface of gnathosoma with only a weakly defined trough in which are found the peritremes, not sharply depressed as in *Pimeliaphilus gloriosus.* Dorsal seta of femur of palp (fig. 50) about twice as long as in *P. gloriosus,* 84μ cf. 43μ.

No trace of a division in any of the femora. Distal solenidion of tarsus I perhaps not so distally displaced (.47 in the Texas specimen) as in *P. gloriosus* (.53–.56)[5], but material is inadequate. Other features are similar to *P. gloriosus.*

Male. Scutum (fig. 54) less elongate than in *Pimeliaphilus gloriosus.* The first two pairs of setae behind the scutum are on widely separated, setigerous sclerites of ordinary size and form, rather than on a common sclerite, but the two pairs behind those are as in *P. gloriosus.* Number and form of setae on genitoanal papilla essentially the same as in *P. gloriosus* (figs. 28, 29). Chaetotaxy of palpi and legs also as in *P. gloriosus.*

Type locality and host. Colossal Cave, about thirty miles east of Tucson, Arizona, one female, one male, and one larva on *Triatoma recurva* (Stål) 1868, 16 June 1964; R. C. Anderson. Holotype female to be deposited in USNM.

Additional collection. Harper, Gillespie County, Texas, on *Triatoma gerstaeckeri* (Stål) 1859, 23 September 1964; J. S. Wiseman.

Remarks. The mite from Texas was similar to the female from Arizona in all major respects. Coxa IV of one side (see fig. 56) had a seta, but this was absent from the other side. The femoral setae of the palpi measured 86 and 92μ, while the distal solenidion of tarsus I was shorter (51μ) than in the Arizona form. The scutum was considerably longer (130 cf. 100μ), but the positions of the setae were very similar. The Arizona locality was selected as the type locality because of the presence of both sexes in the collection from Colossal Cave.

In the tabular key (table 2), measurements for the Arizona and Texas forms are combined in one line.

Pimeliaphilus joshuae n. sp.

Female. Idiosoma (fig. 69) 430–522μ long, 261–317μ wide, L/W 1.61–1.65 (1.64)[3]. Striations of scutum (fig. 70) blending almost imperceptibly into the striae of the rest of the propodosoma, so that the scutum is only very weakly demarcated; three pairs of long, peripectinate setae present, the third pair 145–192(175μ)[3] long. Ocular plate with one seta. Fourteen pairs of dorsal and marginal setae. Anal cleft considerably longer dorsally than in *Pimeliaphilus gloriosus,* about equal to that of *P. triatomae* Cunliffe 1952. Anal papilla (figs. 64, 65) largely concealed by the posterolateral lobes of hysterosoma which project beyond it; striae of anal papilla more delicate than those of the rest of the hysterosoma.

Coxal setae 2-2-3-1, the median seta of I and II more slender than the lateral seta and appearing smooth at magnifications of 120 × or less. At higher magnifications, they are sparsely peripectinate like the other ventral setae (fig. 68). Median seta of coxa II 47–71(60μ)[3] long. The median seta of III is nearly as heavy as the lateral setae. Supracoxal seta of I short, ovoid, hollow, apparently not recessed (material not ideal for observation). Ventral postcoxal setae as in *Pimeliaphilus gloriosus,* differing only slightly in position and in length. Genital and anal openings flanked by seven pairs of ventral and marginal setae (fig. 64).

Peritremes not reaching to margins of gnathosoma. Supracoxal setae like those of I, only partially recessed at most, but material was not favorable for study. Rostrum relatively longer and more slender than that of *Pimeliaphilus gloriosus,* with a single pair of peripectinate setae near the base. Rostral flange a wedge-shaped structure (see under character 3), narrower than the rostrum at that point (fig. 63). Femoral seta of palp very long, tarsal chaetotaxy (fig. 62) as in *P. gloriosus.* Setae of legs relatively longer, but number on various segments as given in the table for *P. gloriosus.* Other details as shown in the figures or in the tabular key (table 2).

Male. A single specimen collected only a few miles from the type locality probably belongs to this species. It is not in suitable condition for illustration, but is similar in general appearance to the male of *Pimeliaphilus gloriosus.* However, each of the posterior plates encloses three setae rather than two, the third seta being the one which lies in the membranous cuticle behind the plates in question in *P. gloriosus.* Moreover, this third seta is more laterally placed in *P. joshuae* (fig. 78) than it is in *P. gloriosus* (fig. 30). The anterior sclerites do not appear to be divided by striate cuticle as they are in at least some specimens of *P. gloriosus.*

Type locality. About five miles south of Twentynine Palms, San Bernardino County, California, holotype female and one paratype female in roots of dead joshua tree (*Yucca brevifolia*), 27 January 1957; I. M. Newell.

Other collection data. Same locality and habitat, two females, one deutonymph, one larva, 9 July 1964; I. M. Newell.

One mile west of Twentynine Palms, San Bernardino County, California, same habitat, one male, one deutonymph, 9 July 1964; I. M. Newell.

Pimeliaphilus triatomae Cunliffe

The following notes are based upon specimens sent to us by the late Flavio da Fonseca and compared by us with Cunliffe's (1952) description of that species. The morphological agreement was very good, and the source of the material was a laboratory colony of *Triatoma infestans* at Lima, Peru, collected by A. Tejada. The type locality for *Pimeliaphilus triatomae* was Santiago, Chile, and the type host was the same species from which the specimens seen by the authors were obtained. The species will not be rediagnosed here, but the major points of difference between this and other species can be seen in the tabular key (p. 417). Outstanding character variants in the female are the unusually slender scutum (L/W = 1.90), the posterior displacement of the third pair of scutal setae (at .83), the form of the rostral flange, and the exceptionally long legs (as indicated by character 22). Also, the exceptional lengths of all solenidia (characters 24, 25, 26, 27). In these characteristics, *P. triatomae* is very similar to *P. cunliffei,* although the two species differ markedly in a number of respects. Like the solenidia, the normal setae are also extremely long (as indicated by characters 20 and 21).

Known distribution. Peru, Chile, Argentina.

Pimeliaphilus cunliffei Jack

This species was originally believed to be *Pimeliaphilus podapolipophagus* Trägårdh 1905 by Cunliffe (1952, pp. 160–61), but Jack (1961, pp. 306–8) concluded correctly that Cunliffe had misidentified his material. Both descriptions which have been published to date leave a number of points of doubt about important morphological variants in this form, but the ones shown in the tabular key (p. 417) summarize those which appear to be most certain. No lengths or ratios were given in the descriptions by either Cunliffe or Jack, so that these have been worked out from their illustrations. This was done as carefully as possible, but the data should be used with some reservations. For this reason, superscripts are omitted from the data in the tabular key.

Known distribution. United States (Maryland, and foreign quarantine interceptions).

Pimeliaphilus podapolipophagus Trägårdh

Female. The species has been described twice, by Trägårdh (1905, pp. 32–46) and by Jack (1961, pp. 305–8), and will not be redescribed here except to summarize the character variants in the tabular key. Through the kindness of G. O. Evans, of the British Museum (Natural History), the authors were loaned a "cotype" of this species, and the data in the key noted above were obtained entirely from their restudy of this specimen. Whether or not this is the same specimen that Jack saw is not known, but a few points of discrepancy between Jack's redescription and the species studied by the present authors will be indicated, since they involve structural details which have been found important in differentiating between species of this genus, and even for defining the genus itself. Jack showed a barred, blunt-tipped seta at .42*d,* ostensibly a solenidion. Actually, this seta is not a solenidion but a companion seta tapering uniformly to a fine tip and having a solid shaft, without any trace of banding. The solenidia in *Pimeliaphilus podapolipophagus* are the ones shown in Jack's figure 2, *A,* at .25*d* and at .45*d.* These solenidia are found in approximately these positions in all species of the genus. The distal solenidion in *Pimeliaphilus* is marked with many minute fenestrations, visible at 450 × or above, which probably are points at which the distal dendrites of the sensory neurons reach to, or very nearly to, the surface of the solenidion. At any rate, it is longer than the associated companion seta. (In *Hirstiella,* the reverse is true, the companion seta being longer than the solenidion.)

The dorsal setae are longer than indicated by Jack; for example, the third scutal setae are approximately 155μ long, and extend beyond the posterior end of the scutum when viewed flat. The ventral setae are also longer than indicated, the median seta of coxa II, for example, measuring 37μ in length. The dorsal seta of the patella of the palp is lightly barbed rather than smooth. Other data are presented in the tabular key.

Morphological Characters and Variants in *Pimeliaphilus,* and Tabular Key Based on Adult Females

On the basis of available evidence, the genus *Pimeliaphilus* could be a very large one, only a few species of which are presently known. According to Sjogren and Ryckman (1966), the possible hosts comprise fourteen genera and approximately seventy-nine species, only a few of which have been examined for *Pimeliaphilus.* Moreover, the genus is not restricted to Hemiptera. However, the known species probably show most of the characters which are of value in differentiating between species. The authors feel that it would be useful to set these out in detail, not only to define the genus better by indicating the principal character variants presently known, but also to minimize taxonomic difficulties as new species are described. Those characters are presented first which show more or less discontinuous types of variation, followed by those which vary continuously over a fairly definite range. The summary statement of each character and the known variants is followed by brief explanatory notes as necessary. To use this as a key to identify the described forms, only a few characters may be necessary, but new forms should be more fully diagnosed, using as many of the characters set forth here as possible. Characters 1 through 6 facilitate most rapid diagnosis of the known species, and are placed at the beginning of the key for that reason.

Characters showing relatively discontinuous variation

1. Division of femora I and IV.
   - a: No trace of a division in either femur I or IV; five segments beyond the coxa.
   - b: Femora I and IV both divided by a cincture line to form a basifemur and telofemur.

Before definitely recording any species as exhibiting variant a, it should be verified that the specimen is an adult female. Species showing variant b in the adult stage have deutonymphs with undivided femora on all legs.

2. Form of medial seta of coxa II.
   - a: Slender, appearing smooth at low magnification ($< 300\times$) with only a very few barbs at most, visible at magnifications $> 300\times$ (fig. 57).
   - b. Appearing sparsely barbed basally at magnifications of $300\times$ tapering to a slender point (fig. 68).
   - c: Appearing stiff, peripectinate throughout, even at magnifications $< 300\times$ (fig. 44).

The form of the other ventral setae appears to be closely linked to this. For example, in *Pimeliaphilus plumifer* all the ventral setae, including those of the gnathosoma, have much the same form as the medial setae of coxae II. However, this is not invariable. In the known forms, variation in this and character 7 fairly well define most of the variation in the ventral setae.

3. Form of rostral flange.
   - a: Rostral flange forming a collarlike expansion proximal to the velum (fig. 10), appreciably wider than the rostrum at this point.
   - b: Rostral flange tonguelike or wedge-shaped, no wider than the rostrum as seen in ventral view (fig. 63).
   - *New term:* The rostral flange is the stiff, hyaline shelf just proximal to the striated membranous velum.

4. Form of ventral setae of gnathosoma.
   a: Smooth, slender (fig. 16).
   b: Sparsely barbed in basal one-half, then tapering to a very fine point (fig. 46).
   c: Distinctly peripectinate throughout length (fig. 42).

5. Which pair of scutal setae is more widely separated, 1 or 3?

In *Pimeliaphilus joshuae,* the first and third pair are so nearly equally spaced that either variant may be found in any particular individual, or the setae may be essentially identically spaced. Hence, both variants are given.

6. Number of setae on coxae IV (1 or 0).
   Coxal setae I–III are apparently constant at 2-2-3.

7. Form of lateral seta of coxa II (cf. character 2).
   a: Smooth, slender, at most with two or three delicate barbs visible at high magnifications.
   b: Sparsely barbed in basal one-half, then tapering to a smooth, slender point.
   c: Distinctly peripectinate throughout length.

8. Number of pairs of dorsal and medial setae (12–16). This includes the setae of the scutum and ocular plate, but excludes the three pairs found on the anal papilla. It is subject to some variation with degree of engorgement because one of the ventral pairs sometimes will become marginal in position in fully replete individuals.

9. Form of dorsalmost setae of anal papilla.
   a: Penicillate, peripectinate.
   b: Tapering to a very fine point and lightly pectinate.
   c: Arboriform (figs. 7, 39).
   d: Smooth, not pectinate.

Intermediate conditions may exist, in which case more than one symbol may be used.

10. Position of ventral setae of gnathosoma, as seen in ventral view.
    p: Proximal to level of insertions of palpi.
    d: Distal to level of insertions of palpi.
    e: At same level as insertions of palpi.

11. Femur and patella of palp fused (f) or not fused (n).

12. Form of dorsal seta of femur (or femoral portion) of palp.
    a: Penicillate, barbed (fig. 4).
    b: Sparsely barbed, tapering to a fine point.

13. Form of dorsal setae between the paired dorsal eupathidia of tarsus I (compressed specimens, oil immersion, if necessary). See figures 66 and 73.
    f: Frond-shaped, bipectinate.
    s: Slender, smooth, or delicately peripectinate.

Continuously varying characters

The following characters show more variation than the foregoing ones, and consist of measurements, ratios, or decimal positions of setae, and so forth. Nevertheless, they are often very diagnostic. For example, the third scutal setae in *Pimeliaphilus plumifer* range from 148 to 161μ in length in the specimens measured. While one could not rely on this character to differentiate *P. plumifer* from *P. triatomae* or *P. joshuae,* the exceptionally long setae of *P. andersoni* (245μ) would serve readily to differentiate that species from other known forms. Certain setal lengths appear to be correlated consistently. For example, the dorsal idiosomal setae in a given species appear to be of the same relative length. Since the third scutal setae are readily identified, these have been selected for measurement. Lengths of solenidia also appear to be correlated to a certain extent. For example, the longest solenidia on tarsi I, II, and III are found in *P. triatomae,* at least among the species studied. However, the shortest solenidia at these positions are not found in any one species. In other words, the relative lengths of solenidia are not invariably correlated with each other, and they are certainly not correlated with the length of the idiosomal setae (compare variants in characters 10 and 25). There appears to be a general relationship between the length of the solenidia of the palpal tarsus and the distal solenidion of tarsus I, but the difficulty of getting data on the palpal solenidia precludes critical comparisons, and greatly reduces the diagnostic value of this character.

14. Length of idiosoma, to tip of anal papilla, but excluding idiosomal setae projecting beyond the posterior margin of the body. Where material is limited, there should be an indication of the degree of engorgement. In probably all species of the genus, the largest individuals will measure nearly twice the length of the young females which have just emerged from the tritonymphal cuticle.

15. L/W of idiosoma (1.13–1.65). Surprisingly, this character seems to be little affected by the degree of engorgement in *Pimeliaphilus gloriosus* and other species, but in *P. plumifer* it *is* affected.

16. Length of third scutal setae (116–245μ). As explained above, this gives a fairly good index of the relative length of most other dorsal setae as well. The setae must be reasonably horizontal, as in compressed specimens.

17. Length of medial seta of coxa II (18–71μ).

18. Width of peritreme/width of base of gnathosoma (.40–1.32). The gnathosoma should not be unduly compressed, as this will lead to values lower than are found in the living mite.

In *Pimeliaphilus cunliffei,* the peritremes extend beyond the margins of the gnathosoma (1.32), but in all other forms the values are less than 1.0.

19. Length of dorsal seta of femur (or femoral portion) of palp (24–92μ). This is in part correlated with character 16, but there are significant exceptions. For example, compare *P. andersoni* and *P. podapolipophagus* with respect to these two characters.

20. Length of anterior seta of trochanter I (41–108μ).

21. Length of dorsal seta of tibia II (30–125μ).

Characters 20 and 21 provide an index of relative length of the longer setae of the legs. These range from very short in *Pimeliaphilus peninsularis* to extremely long in *P. joshuae.*

22. Length of tibia IV (58–133μ). This reflects differences between species with respect to long-leggedness. While critical studies have not been made, the relationships are probably close enough to permit the use of this simple measurement rather than the more difficult one of the total length of the leg.

23. Position of proximal solenidion of tarsus I (.17–.36 in known forms).

24. Length of proximal solenidion of tarsus I (17–48μ). The tarsus must be viewed in profile. The length is defined as the shortest chord between the base of the seta and the tip, rather than the length along the curvature.

25. Length of distal solenidion of tarsus I (40–76μ). The solenidion should be measured as in character 24.

26. Length of solenidion of tarsus II (5–24μ).

27. Length of solenidion of tarsus III (3–18μ).

28. Median length of scutum (100–157μ). This should be measured to the anteriormost point on the midline of the scutum, regardless of whether the anterior margin is convex, straight, or concave.

29. Median length/maximum width of scutum (.64–1.83). The maximum width is usually found at the level of the first pair of scutal setae, but sometimes at the level of the third pair (*Pimeliaphilus andersoni*).

30. Level of setae 1 of scutum (–.19 to .08). Characters 30 through 34 are analyzed by making a camera lucida drawing of the scutum, marking clearly the anterior and posterior limits, and the centers of the bases of the three pairs of scutal setae. Horizontal lines drawn between left and right members of each pair of scutal setae, as shown in figure 35, intersect the midline at points which represent the level of that particular pair of setae. The levels are expressed as a decimal representing the displacement of the points of intersection relative to the midline length of the scutum. If the intersection lies anterior to the midpoint of the anterior margin, the decimal position is given as a minus value.

31. Level of setae 2 of scutum (–.06 to .38). This may be either a positive or negative value, depending upon the degree of displacement of these setae.

32. Level of setae 3 of scutum (.14 to .83). This is a positive value in all forms described so far.

33. Interval between setae 1 of right and left sides/level of setae 3 minus level of setae 1 (.64–3.39). This provides a measure of the degree of separation of scutal setae 1 and 3 relative to the separation between setae 1; in other words, the shape of the rectangular field including setae 1 and 3.

34. Level of setae 2–3/level of setae 1–2 (1.12–8.00). This gives a very sensitive measure of the relative distances between the levels of the three pairs of scutal setae, and is quite variable. It appears to be largely independent of other parameters of setal position.

35. Known geographical distribution (North America, South America, Africa).

Table 2 shows the distribution of variants, given in the foregoing thirty-five character groups, among the ten species of *Pimeliaphilus* discussed in this paper.

TABLE 2

TABULAR KEY TO DISTRIBUTION OF VARIANTS*

Pimeliaphilus species	1	2	3	4	5	6	7	8	9	10	11
andersoni	a	a	a	a	3	0,*1*†	a	14	c	p	n
podapolipophagus	a	a	b	a	3,1	1	a	13	d*b*	p	n
cunliffei	a	a?	?	?	3	1	a?	13	?	?	f
gloriosus	b	a	a	a	1	0	c	12–13	c	d*e*	n
sanguisugae	b	a	a	a	1	1	c	13–14	c	d	n
joshuae	b	b	b	b	3,1	1	c	13	c	e	n
peninsularis	b	c	a	a	1	1	c	?	c	d	n
calimesae	b	c	a*b*	b	1	1	c	13	c	d	n
plumifer	b	c	a	c	1	1	c	14	ac	d	n
triatomae	b	c	b	a	1	1	c	12–13	a	d	n

Pimeliaphilus species	12	13	14	15	16	17	18
andersoni	a	f	592–626(609μ)^{2}	1.29–1.41(1.35)^{2}	244–245(245μ)^{2}	49μ^{1}	.89^{1}
podapolipophagus	b	f	670μ^{1}	1.48^{1}	155μ^{1}	37μ^{1}	1.00^{1}
cunliffei	b?	s	?	1.44	?	?	1.32
gloriosus	a	f	392–722(560μ)^{10}	1.13–1.19(1.17)^{10}	116–131(124μ)^{8}	27μ^{1}	.66–.76(.70)^{5}
sanguisugae	a	?	461–618(540μ)^{2}	1.20^{1}	120–139(130μ)^{2}	24μ^{1}	.94–.95(.95)^{2}
joshuae	a	f	430–522(474μ)^{3}	1.61–1.65(1.64)^{3}	145–192(175μ)^{2}	47–71(60μ)^{3}	.82^{1}
peninsularis	a	f	557μ^{1}	1.45^{1}	?	18μ^{1}	.59^{1}
calimesae	a	f	444–827(635μ)^{7}	1.40–1.57(1.48)^{5}	135–155(147μ)^{5}	29–33(30μ)^{5}	.40–.59(.52)^{5}
plumifer	a	f	470–587(532μ)^{5}	1.24–1.64(1.45)^{5}	148–161(155μ)^{4}	25–29(28μ)^{4}	.76–.78(.77)^{2}
triatomae	a	s	583–1100(842μ)^{2}	1.33–1.64(1.49)^{2}	145–165(158μ)^{4}	52μ^{1}	.87^{1}

Pimeliaphilus species	19	20	21	22	23	24
andersoni	84–92(87μ)^{3}	41–45(43μ)^{2}	98μ^{1}	71μ^{2}	.32^{1}	17–20(19μ)^{2}
podapolipophagus	73μ^{1}	89μ^{1}	125μ^{1}	84μ^{1}	.26^{1}	33μ^{1}
cunliffei	?	?	?	?	.22–.24(.23)	48μ
gloriosus	39–45(42μ)^{5}	49–59(56μ)^{7}	39–47(43μ)^{7}	69–71(70μ)^{3}	.27–.31(.29)^{5}	26–28(27μ)^{2}
sanguisugae	69μ^{2}	65–73(69μ)^{2}	69–71(70μ)^{2}	73–76(75μ)^{2}	.21^{1}	29–38(34μ)^{2}
joshuae	67–84(78μ)^{3}	78–104(91μ)^{4}	106–135(123μ)^{4}	81–104(94μ)^{3}	.17–.21(.19)^{3}	20–34(27μ)^{2}
peninsularis	?	41μ^{1}	30μ^{1}	58μ^{1}	.27^{1}	22μ^{1}
calimesae	24–35(30μ)^{4}	61–67(64μ)^{5}	48–57(54μ)^{5}	71–88(85μ)^{5}	.26–.35(.29)^{5}	27–31(29μ)^{5}
plumifer	37–41(39μ)^{3}	54–66(61μ)^{5}	51–63(57μ)^{5}	74–90(84μ)^{4}	.29–.36(.32)^{3}	30–32(31μ)^{2}
triatomae	45–48(47μ)^{2}	106–108(107μ)^{2}	115–122(119μ)^{2}	106–133(115μ)^{4}	.22–.24(.23)^{2}	43–44(44μ)^{2}

Pimeliaphilus species	25	26	27	28	29	30
andersoni	51–67(59μ)^{2}	9–12(10.5μ)^{2}	4–5(4.5μ)^{2}	100–131(116μ)^{2}	.64–.70(.67)^{2}	−.08 to −.13(−.11)^{2}
podapolipophagus	42μ^{1}	16μ^{1}	11μ	184μ^{1}	1.40^{1}	−.04^{1}
cunliffei	72μ	?	?	132μ	1.33–1.49	.06 to .08
gloriosus	47–51(49μ)^{2}	7–8(8μ)^{3}	5μ	104–116(111μ)^{5}	.83–.96(.88)^{5}	−.14 to −.19(−.16)^{5}
sanguisugae	49–56(53μ)^{4}	8μ^{2}	4–5μ^{2}	125–139(132μ)^{2}	1.10–1.26(1.18)^{2}	−.01 to .02(.01)^{2}
joshuae	46–59(53μ)^{2}	6–8(7μ)^{3}	6–7(7μ)^{3}	118–141(130μ)^{2}	1.54–1.83(1.69)^{2}	.00^{2}
peninsularis	45μ^{1}	5μ^{1}	5μ^{1}	131μ^{1}	1.44^{1}	.02^{1}
calimesae	40–46(43μ)^{5}	6–7(7μ)^{5}	3–5(4μ)^{5}	123–157(141μ)^{5}	1.42–1.81(1.62)^{6}	−.02 to .03 (.01)^{6}
plumifer	49–54(52μ)^{2}	6μ^{1}	4–5(5μ)^{3}	133–141(138μ)^{3}	1.36–1.45(1.40)^{3}	0.00^{3}
triatomae	75–76(76μ)^{2}	22–24(23μ)^{2}	15–18(17μ)^{2}	143μ^{1}	1.90^{1}	−.01^{1}

Pimeliaphilus species	31	32	33	34	35
andersoni	−.01 to −.03(−.02)^{2}	.21–.22(.22)^{2}	3.11–3.13(3.12)^{2}	2.59–3.16(2.88)^{2}	U.S. (Arizona, Texas)
podapolipophagus	.05^{1}	.53^{1}	.90	5.60^{1}	Egypt
cunliffei	.29 to .38	.75–.80	.64–.71	1.44–2.06	U.S. (Md.; for. quar.)
gloriosus	−.02 to −.06(−.04)^{5}	.14–.20(.17)^{5}	2.99–3.39(3.20)^{5}	1.12–2.16(1.74)^{5}	Mexico (Oaxaca)
sanguisugae	.05 to .08(.07)^{2}	.35–.36(.36)^{2}	2.06–2.22(2.14)^{2}	5.17–5.20(5.19)^{2}	U.S. (Indiana)
joshuae	.12^{2}	.49–.51(.50)^{2}	1.04–1.07(1.06)^{2}	3.17–3.32(3.25)^{2}	U.S. (California)
peninsularis	.09^{1}	.45^{1}	1.26^{1}	5.22^{1}	Mexico (B. Calif.)
calimesae	.07 to .11(.09)^{6}	.44–.50(.47)^{6}	1.01–1.36(1.16)^{6}	4.08–5.88(4.83)^{6}	U.S. (California)
plumifer	.05 to .07(.06)^{3}	.45–.49(.47)^{3}	1.36–1.39(1.38)^{3}	6.43–8.00(7.02)^{3}	U.S. (Ariz., Calif.); Mexico (see p. 408)
triatomae	.18^{1}	.83^{1}	.97^{1}	3.37^{1}	Peru, Chile, Arg.

* The numerical column headings (1–35) refer to the numbered morphological characters and variants described in the preceding text.

† Italicized letters or figures mean "exceptional variant."

Biological Notes on *Pimeliaphilus gloriosus*

Host relationships. *Pimeliaphilus gloriosus* n. sp. was initially collected from its natural host, *Triatoma barberi* Usinger 1939, in Sola de Vega, Oaxaca, Mexico. The kissing bugs were found between adobe bricks near a chicken shelter and in a nearby dwelling (Ryckman, 1962). The mite subsequently has been found to be a problem on laboratory colonies of the Triatoma Protracta Complex. A colony of *Triatoma protracta woodi* Usinger 1939 from Dimmit County, Texas, serving as a laboratory host for these mites, was greatly weakened by the heavy mite population shown in figure 80; this colony of kissing bugs would almost certainly have been killed by the mites if remedial intervention had not been instituted. In the laboratory, *P. gloriosus* has readily parasitized and reproduced on all the other members of the Triatoma Protracta Complex; i.e., *Triatoma protracta* (Uhler) 1894, Mt. Diablo, Contra Costa County, California, and Lincoln County, Nevada; *T. protracta woodi* Usinger, Carrizozo, Lincoln County, New Mexico; *T. protracta navajoensis* Ryckman 1962, Monument Valley, Utah; *T. protracta nahuatlae* Ryckman 1962, Los Mochis, Sinaloa, Mexico; *T. protracta zacatecensis* Ryckman 1962, Durango, Durango, Mexico, and Fresnillo, Zacatecas, Mexico; *T. peninsularis* Usinger 1940, Baja California, Mexico; and *T. sinaloensis* Ryckman 1962, Sinaloa and Sonora, Mexico.

In addition to the above, an experiment was set up to determine what additional Triatominae this species of mite would parasitize. The experiment indicated that, at least in the laboratory, *Pimeliaphilus gloriosus* readily attached to and fed upon *Dipetalogaster maximus* (Uhler) 1894; *Rhodnius prolixus* Stål 1859; *Paratriatoma hirsuta* Barber 1938; *Triatoma rubida* (Uhler) 1894; *T. lecticularius* (Stål) 1859; *T. phyllosoma* (Burmeister) 1835; and *T. brasiliensis* Neiva 1911. These observations were not carried far enough to state whether the mites would reproduce on these seven species, but there is no reason to feel that they would not.

Adult mites were frequently seen attached under the wing pads of fifth-instar *Triatoma* nymphs. In heavy mite populations, the mites may be attached on almost any part of the host's body; i.e., dorsal and ventral body surfaces and on the appendages (fig. 80). In a few instances, mites were even found under the pronotal shield of adult kissing bugs. While a parasitized kissing-bug nymph is molting, the attached mites move from the old cuticle to the teneral bug.

First-instar nymphs of *Triatoma rubida* parasitized by *Pimeliaphilus gloriosus* were introduced into a rearing vial containing first-instar nymphs of the predaceous bug *Reduvius sonoraensis* Usinger 1942. The predaceous bugs killed the *T. rubida* nymphs, and some of the dislodged mites were also eaten; those mites which survived became attached to the predaceous bugs, *R. sonoraensis*. A concerted effort was made to parasitize the cimicid bug *Hesperocimex cochimiensis* Ryckman and Ueshima 1963, but all attempts failed. *P. gloriosus* will crawl upon, but not attach to, this cimicid.

Oviposition. The ovipositing females of *Pimeliaphilus gloriosus* usually attach to the dorsal abdominal surface of adult kissing bugs, and in this position are well covered by the wings of the host (fig. 81). If only nymphal hosts are available, the adult female mites will attach to the thorax or abdomen of the immature bugs. Unless disturbed, the adult mite remains firmly attached by the gnathosoma for life or for relatively long periods of time. One female was observed attached at the same site for over two months. This female laid 169 eggs in 65 days, or 2.6 eggs per day, at a nearly constant temperature of 26.6° C. During the total period of observation she laid 356 eggs, of which a high percentage were fertile.

During oviposition the female mite extrudes the eggs in such a manner as to form a crescent-shaped plaque one layer of eggs thick behind her. This is brought about by a combination of the following factors: (1) Because she is attached by her mouthparts, she is greatly restricted in her movements; however, the posterior portion of the body is capable of moving in an arc of approximately 90°. Hence, the egg plaques often form the crescent-shaped pattern. (2) The eggs appear to be covered with a very stable, nondrying, adhesive substance which holds the eggs together and attaches them to almost any substrate, including the integument of the host bug. The eggs retain their adhesive qualities until they hatch about three weeks later. If a plaque of eggs is touched by the point of a sharp pair of forceps, they will readily adhere to the metal tips. (3) When manipulated, the egg mass will readily form into clumps of almost any configuration; however, when they are extruded into the space between the undersurface of the host's wings and the dorsal surface of the abdomen, the egg plaque is only a single layer thick. A plaque consisting of 187 eggs was removed from behind one ovipositing female mite; these eggs were in all stages of development, from recently laid to hatching. The eggs had remained in place for at least three weeks. The nondrying, adhesive nature of the eggs is a selective advantage to the species because many of the eggs remain on the host until the emergence of the larval mites.

Hatching and larval feeding. Three batches of mite eggs incubated at 26.6° C. hatched in twenty days. When the larval mites are from two to three days of age, they readily attach to almost any portion of the body surface of their host and remain attached for two to four hours, during which time they become replete with the clear body fluids sucked from the host. They then detach, and for a period of two to three days walk actively about the rearing containers. Whether this latter behavior is normal or whether it is associated with the artificial conditions of confinement of the mites is not known. Eventually, they become quiescent and enter the protonymphal stage.

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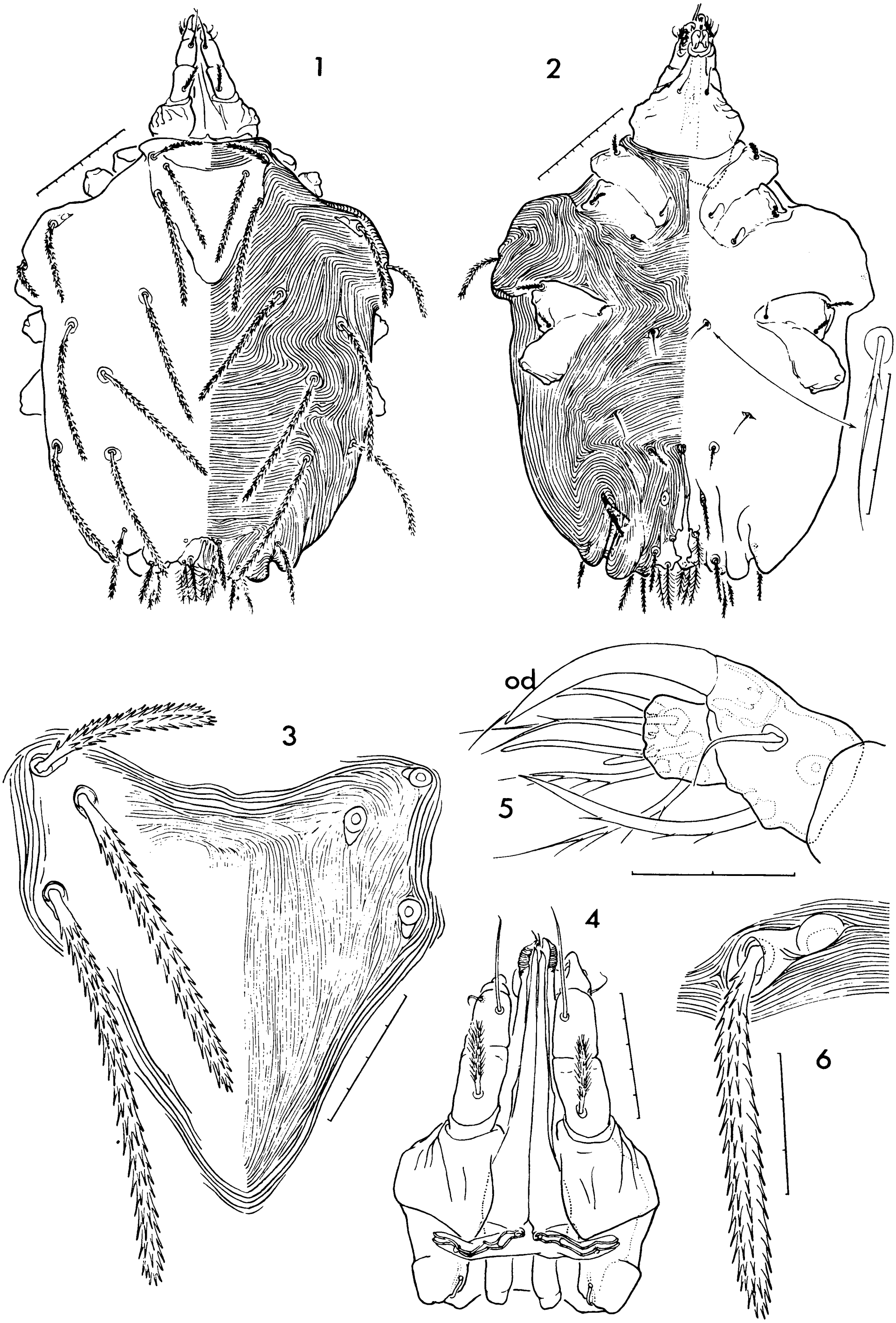
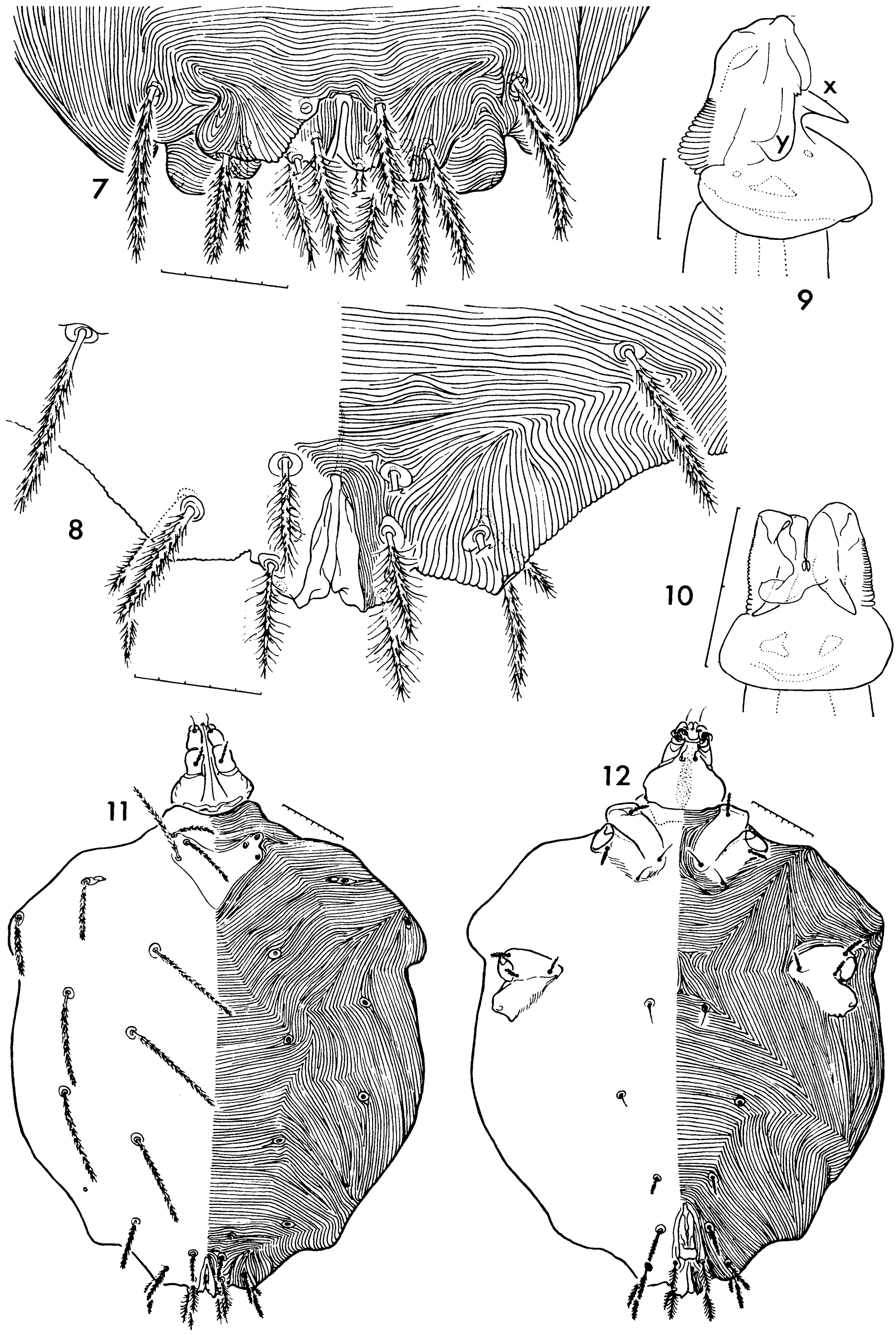
FIGURES

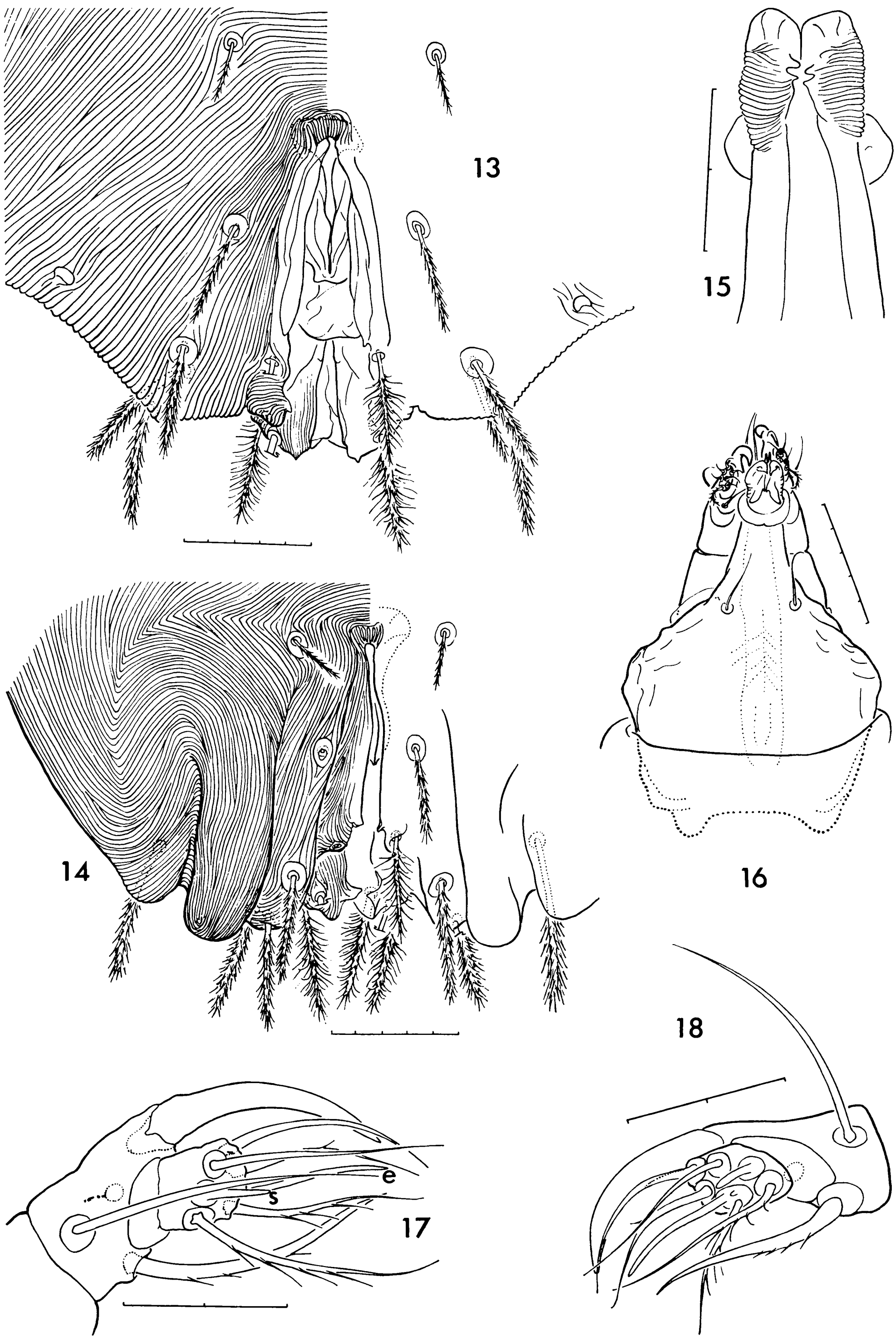
The scales on the drawings are marked in 10-micron units,
so that a scale with three units is
30 microns long, etc.



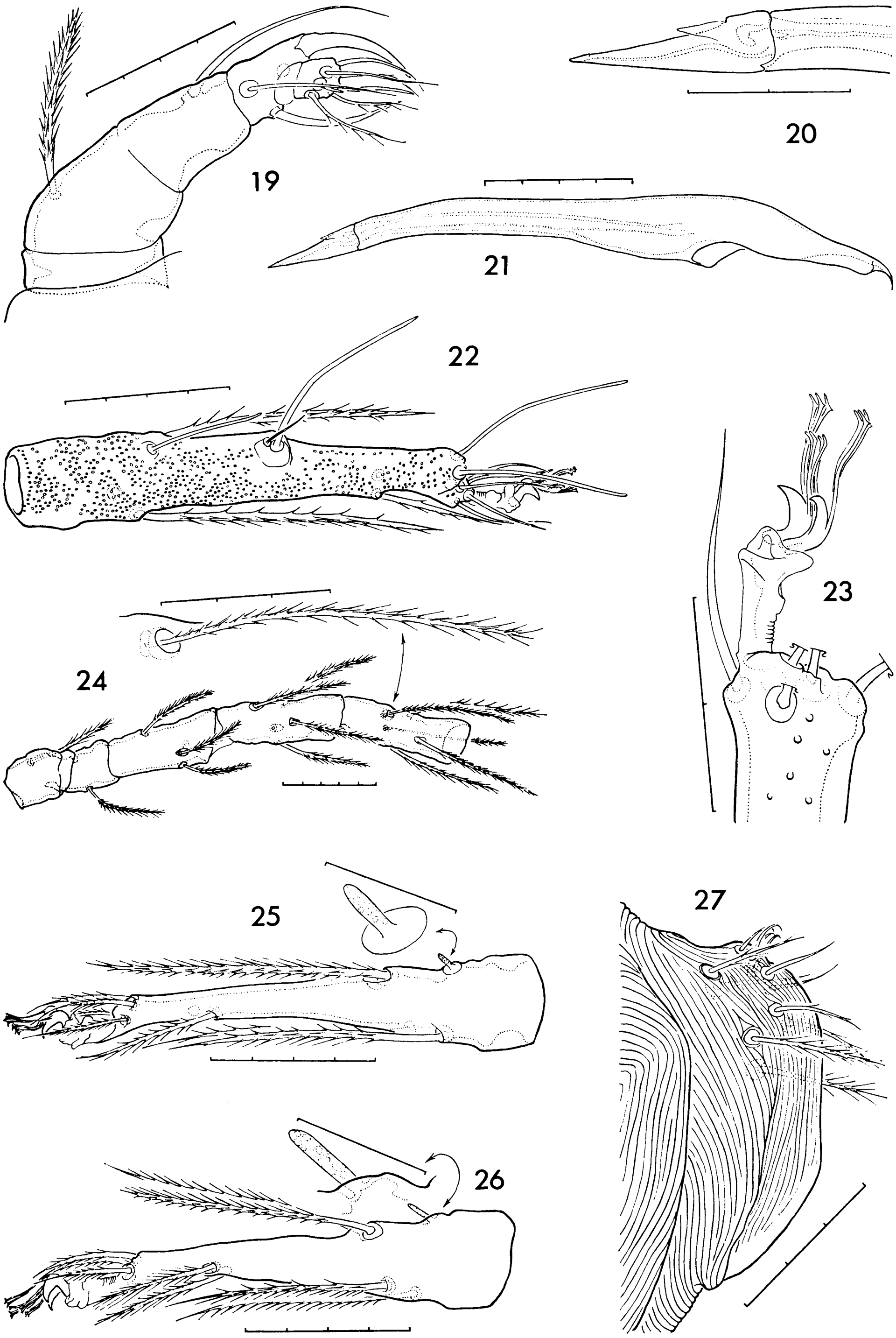
Figs. 1–6. *Pimeliaphilus gloriosus* n. sp. 1. Female (young), dorsal. 2. Female (young), ventral. 3. Female, scutum. 4. Female, gnathosoma, dorsal. 5. Female, tibia and tarsus of right palp, anterior. 6. Female, ocular plate and seta.



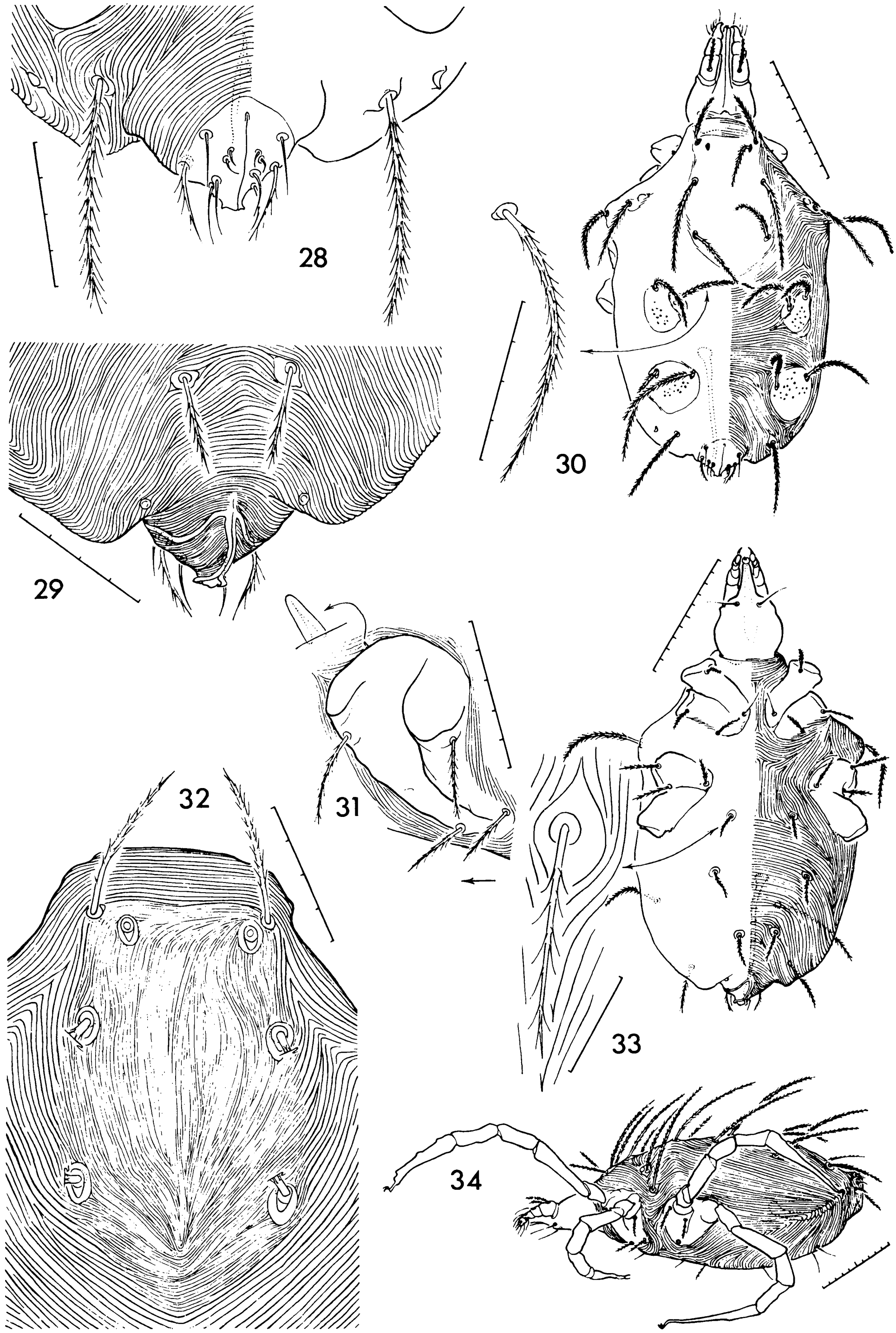
Figs. 7–12. *Pimeliaphilus gloriosus* n. sp. 7. Female (young), tip of opisthosoma, dorsal. 8. Female (old), tip of opisthosoma, dorsal. 9. Female, tip of rostrum, ventrolateral, showing lamellae in end view (*x*) and side view (*y*). 10. Female, velum, lamellae, and rostral flange, ventral. 11. Female (old), dorsal (scutum foreshortened). 12. Female (old), ventral.



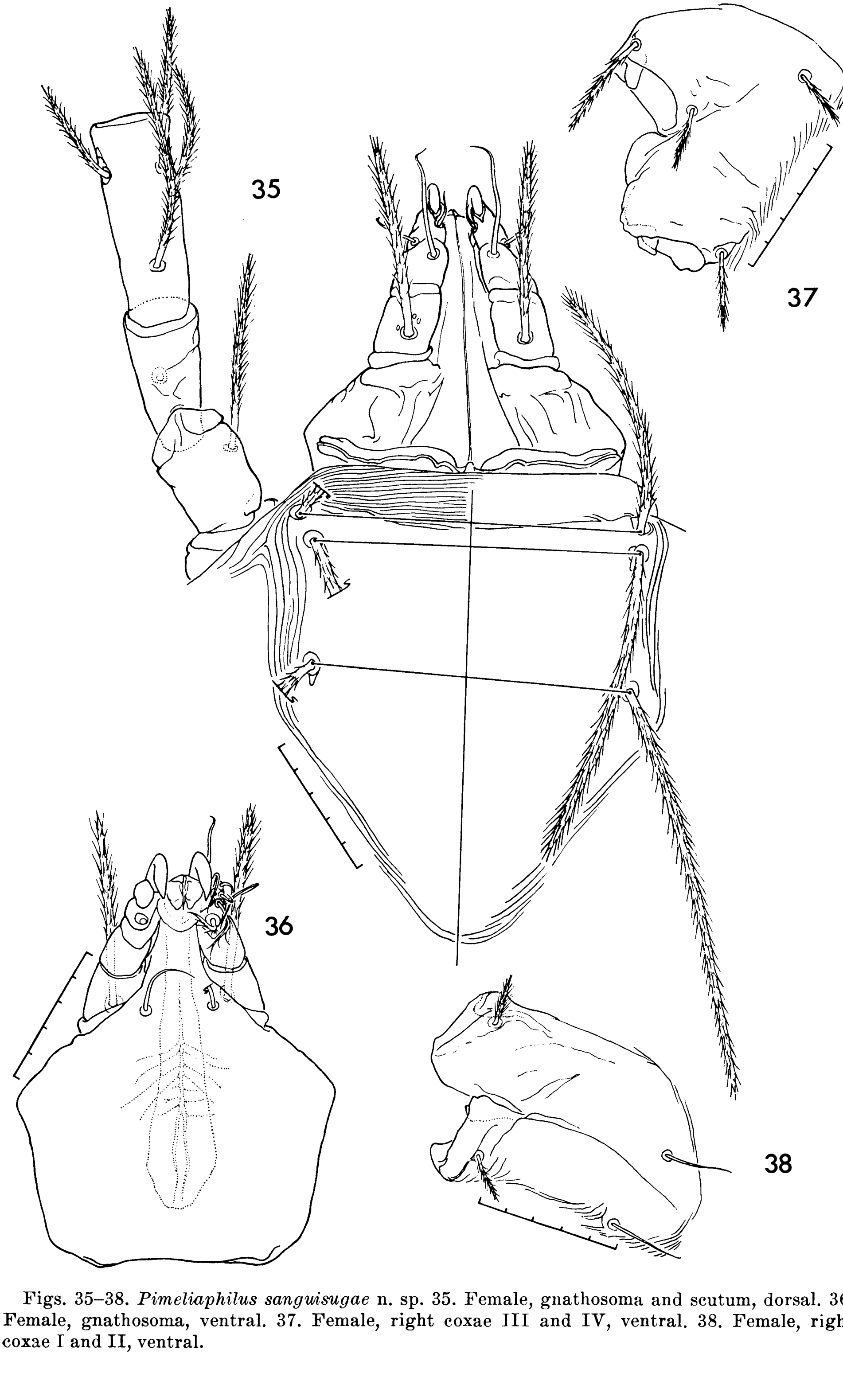
Figs. 13–18. *Pimeliaphilus gloriosus* n. sp. 13. Female (old), genitoanal area, ventral. 14. Female (young), genitoanal area, ventral. 15. Female, tip of rostrum, dorsal. 16. Female, gnathosoma, ventral. 17. Female, tibia and tarsus of right palp, posteroventral. 18. Female, tibia and tarsus of left palp, posteroventral to show eupathid and related setae.



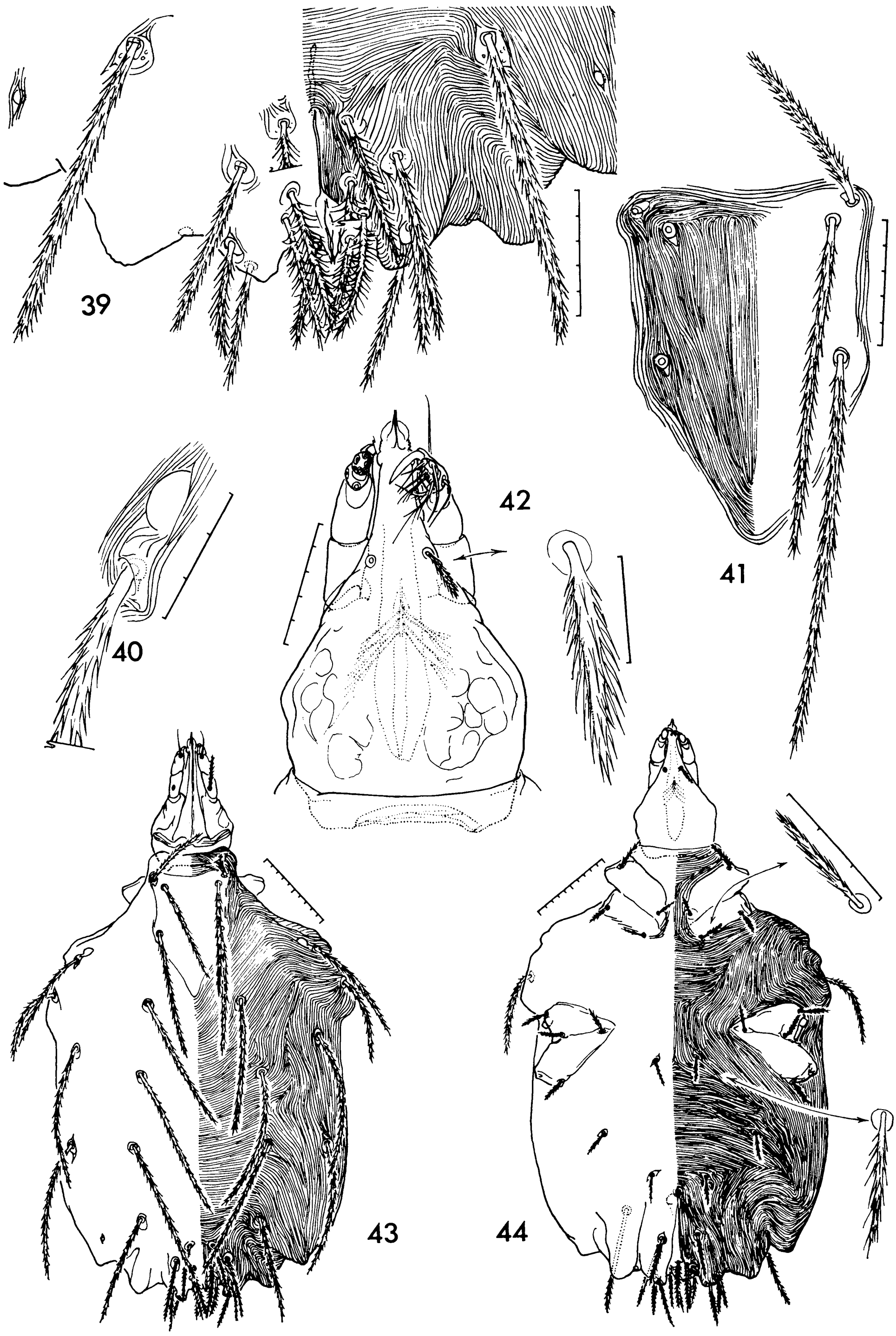
Figs. 19–27. *Pimeliaphilus gloriosus* n. sp. 19. Female, right palp, posteroventral. 20. Female, tip of chelicera. 21. Female, chelicera. 22. Female, tarsus I, posterodorsal. 23. Female, ambulacrum I, anteroventral. 24. Female, trochanter to tibia I, posterodorsal. 25. Female, right tarsus III, anterior. 26. Female, tarsus II. 27. Male, posterior end of opisthosoma, left, lateral.



Figs. 28–34. *Pimeliaphilus gloriosus* n. sp. 28. Male, tip of opisthosoma, dorsal. 29. Male, tip of opisthosoma, ventral. 30. Male, dorsal. 31. Male, left coxae I and II, lateral. 32. Male, scutum. 33. Male, ventral. 34. Male, lateral.



Figs. 35–38. *Pimeliaphilus sanguisugae* n. sp. 35. Female, gnathosoma and scutum, dorsal. 36. Female, gnathosoma, ventral. 37. Female, right coxae III and IV, ventral. 38. Female, right coxae I and II, ventral.



Figs. 39–44. *Pimeliaphilus plumifer* n. sp. 39. Female, tip of opisthosoma, dorsal. 40. Female, left cornea, dorsal. 41. Female, scutum. 42. Female, gnathosoma, ventral. 43. Female, dorsal. 44. Female, ventral.

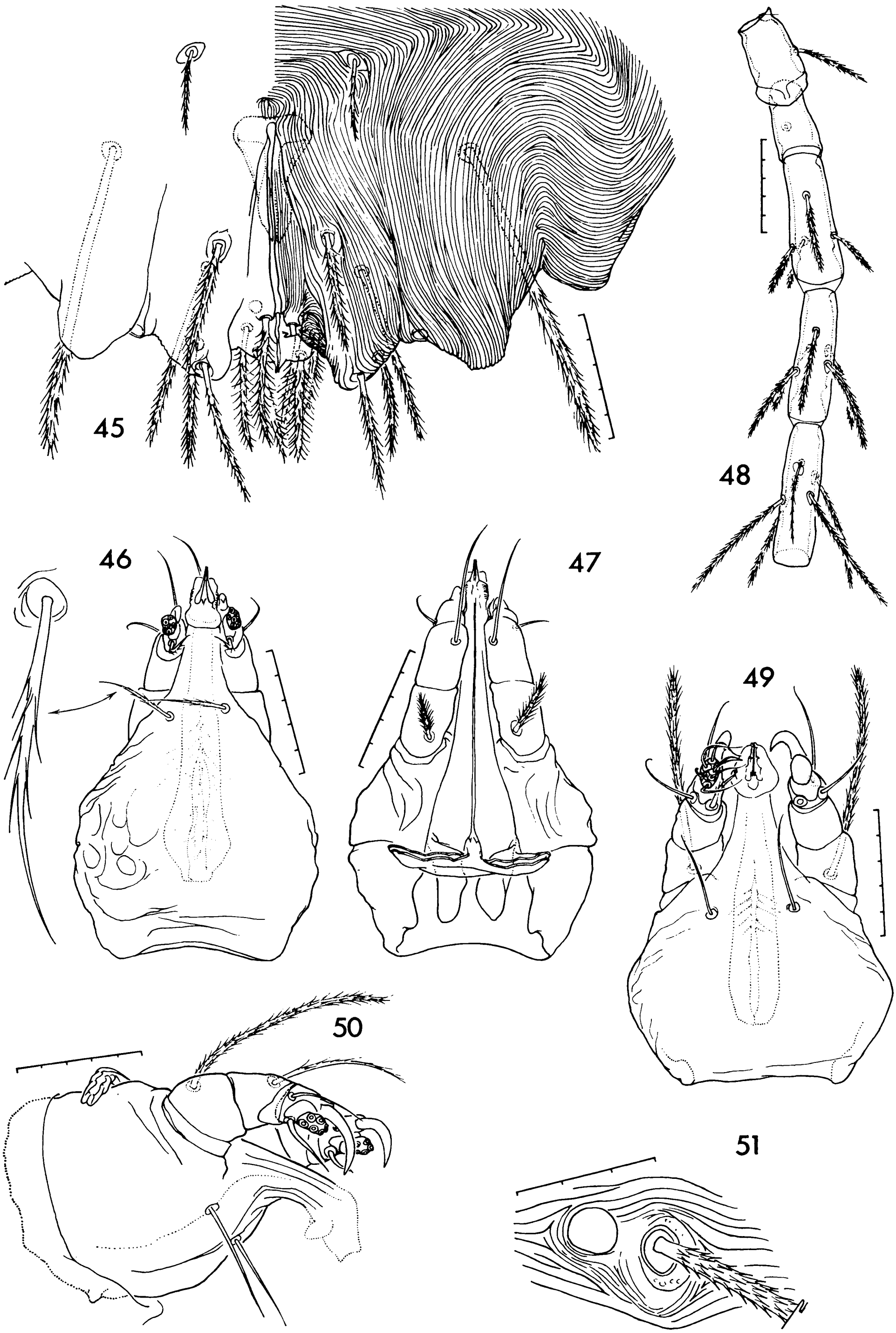
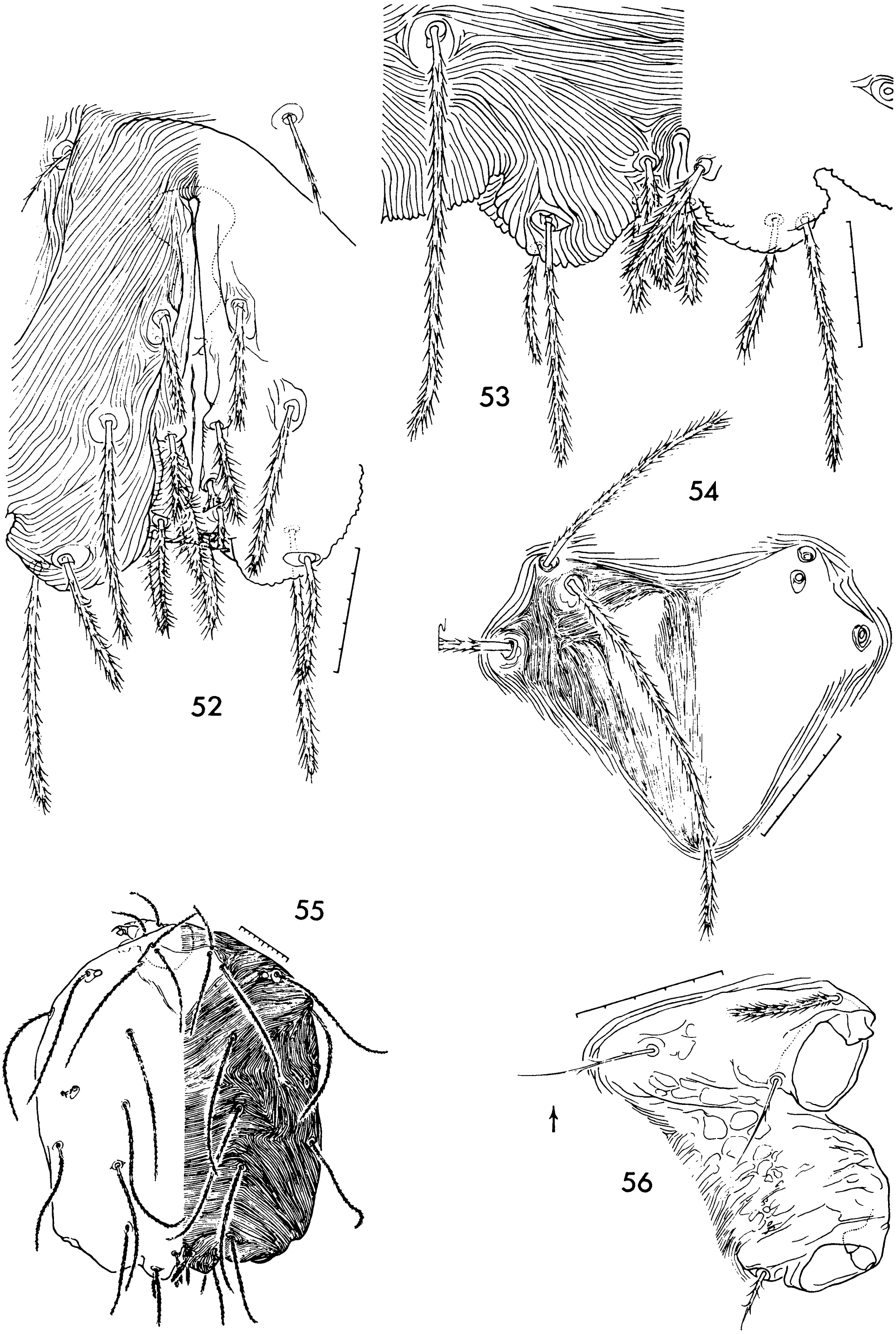
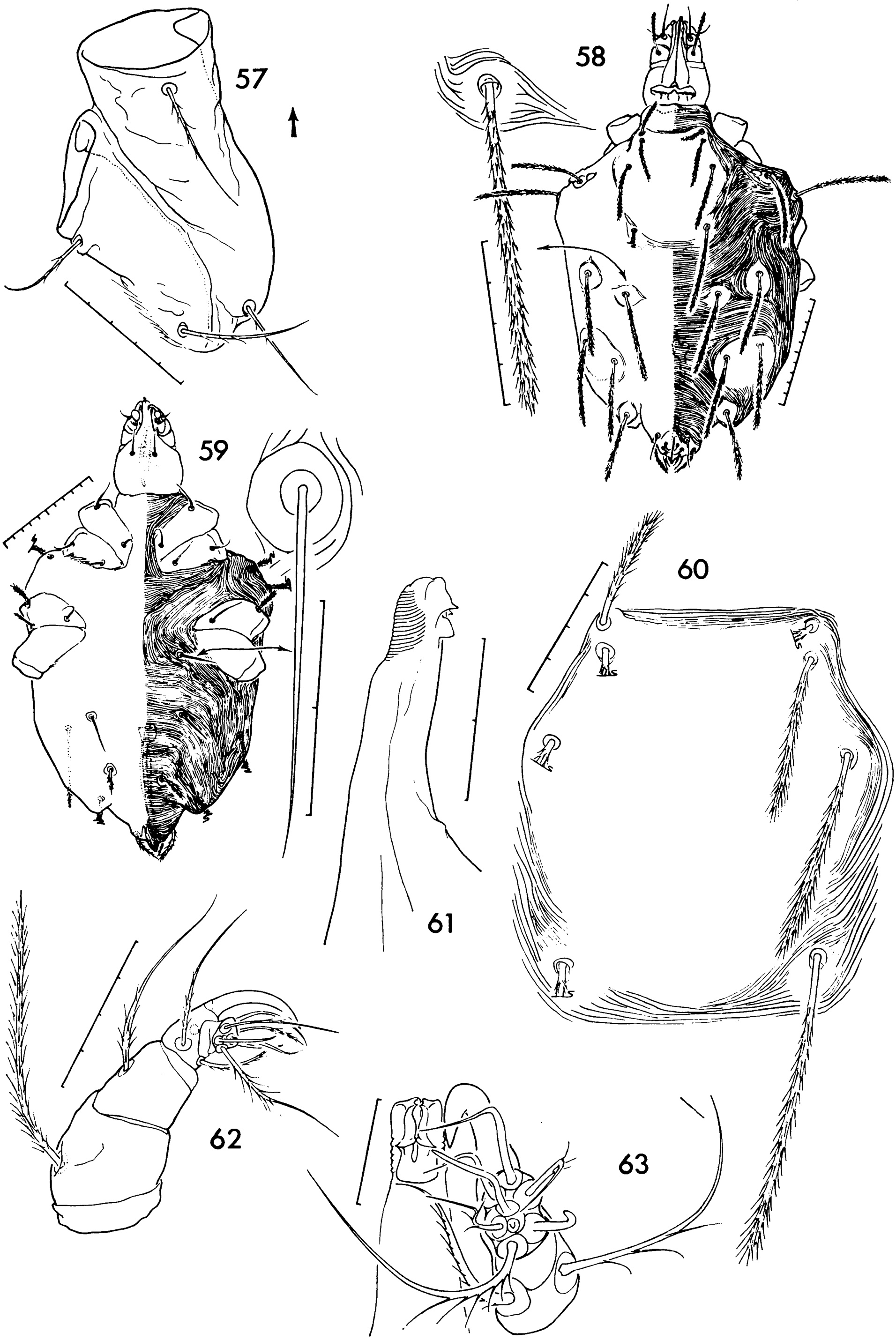


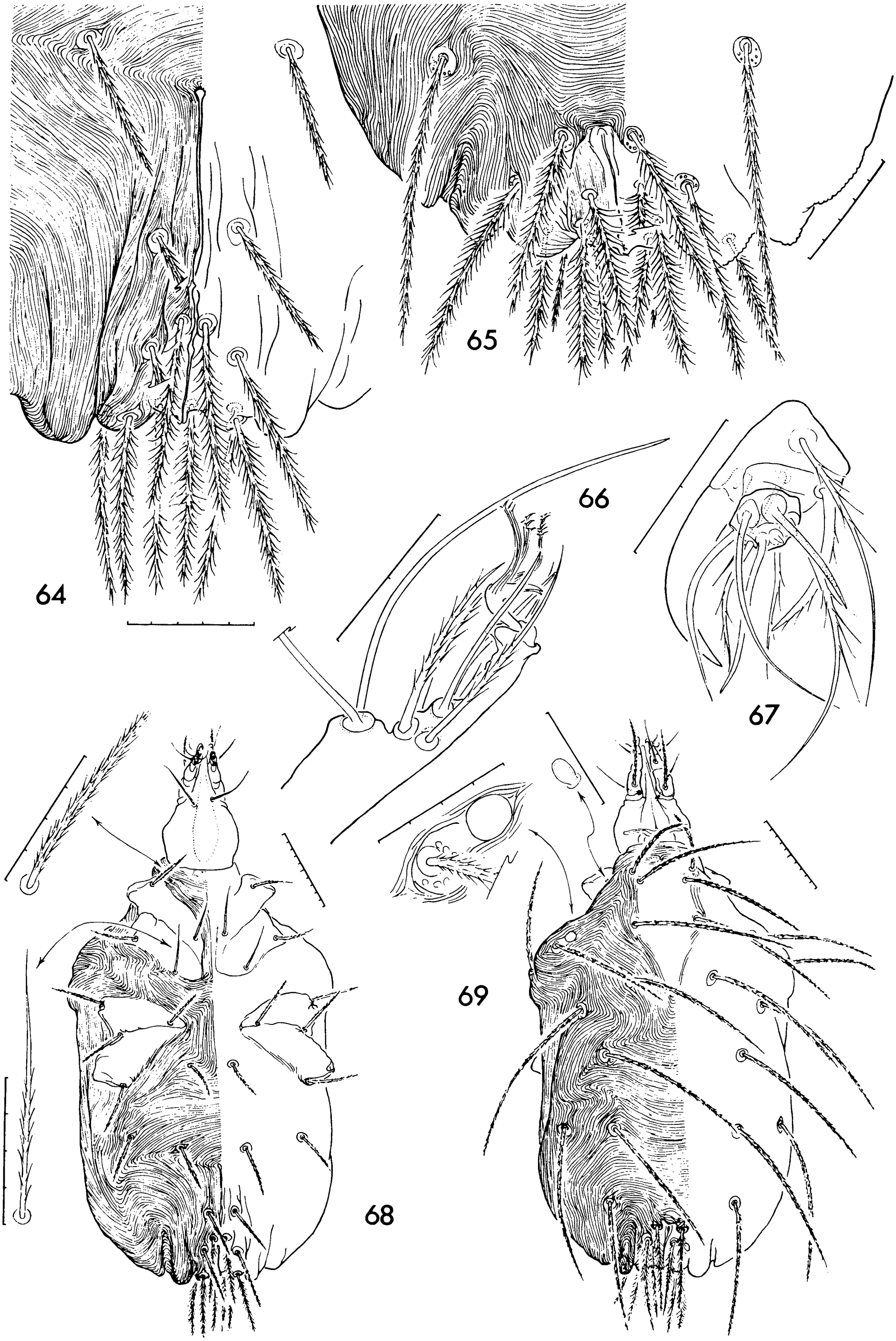
Fig. 45. *Pimeliaphilus plumifer* n. sp., female, genitoanal area, ventral. Figs. 46, 47. *Pimeliaphilus calimesae* n. sp., female, gnathosoma, ventral and dorsal, respectively. Fig. 48. *Pimeliaphilus peninsularis* n. sp., trochanter to tibia I, left, dorsal. Figs. 49–51. *Pimeliaphilus andersoni* n. sp. 49. Female (Arizona), gnathosoma, ventral. 50. Female (Texas), gnathosoma, ventrolateral. 51. Female (Texas), right cornea and seta.



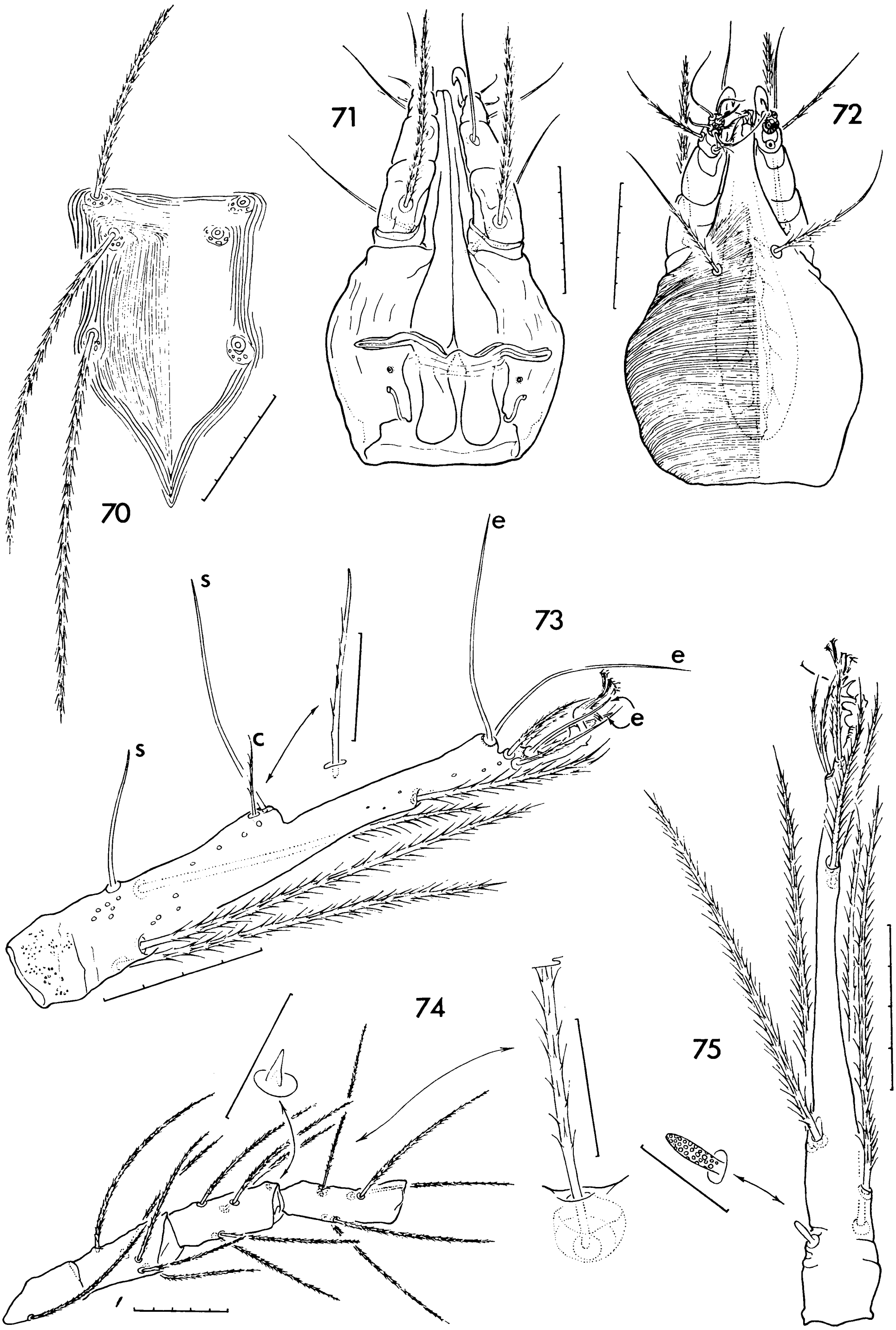
Figs. 52–56. *Pimeliaphilus andersoni* n. sp. (Texas). 52. Female, genitoanal area, ventral. 53. Female, tip of opisthosoma, dorsal. 54. Female, scutum. 55. Female, dorsal. 56. Female, coxae III and IV, left, ventral. (See text, page 411, for discussion of variation in chaetotaxy.)



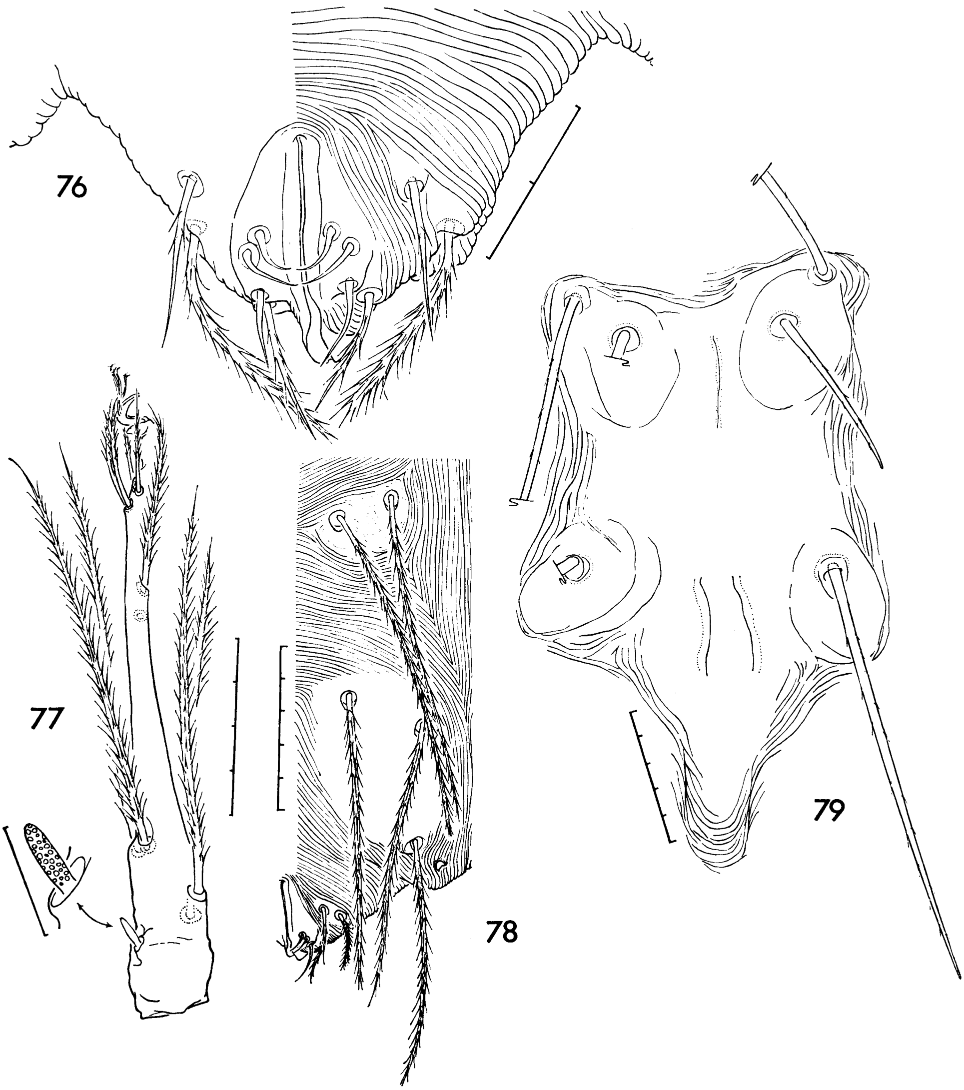
Figs. 57–60. *Pimeliaphilus andersoni* n. sp. 57 (Texas). Female, right coxae I and II, ventral. 58, 59 (Arizona). Male, dorsal and ventral, respectively. 60. Male, scutum. Figs. 61–63. *Pimeliaphilus joshuae* n. sp. 61. Female, rostrum, lateral. 62. Female, right palp, posterior. 63. Female, rostrum, ventral; tibia and tarsus of palp, distiventral view.



Figs. 64–69. *Pimeliaphilus joshuae* n. sp. 64. Female, genitoanal area, ventral. 65. Female, tip of opisthosoma, dorsal. 66. Female, tip of right tarsus I, posterior, showing the two pairs of eupathidia. 67. Female, tibia and tarsus of left palp, posterior. 68. Female, ventral. 69. Female, dorsal.



Figs. 70–75. *Pimeliaphilus joshuae* n. sp. 70. Female, scutum. 71. Female, gnathosoma, dorsal. 72. Female, gnathosoma, ventral. 73. Female, right tarsus I, posterior. 74. Female, right femur to tibia I, posterior. 75. Female, right tarsus III, posterior.



Figs. 76–78. *Pimeliaphilus joshuae* n. sp. 76. Male, tip of opisthosoma, dorsal. 77. Female, right tarsus II, posterior. 78. Male, detail of postscutal plates. Fig. 79. *Pimeliaphilus podapolipophagus* Trägårdh, scutum of "cotype" specimen.

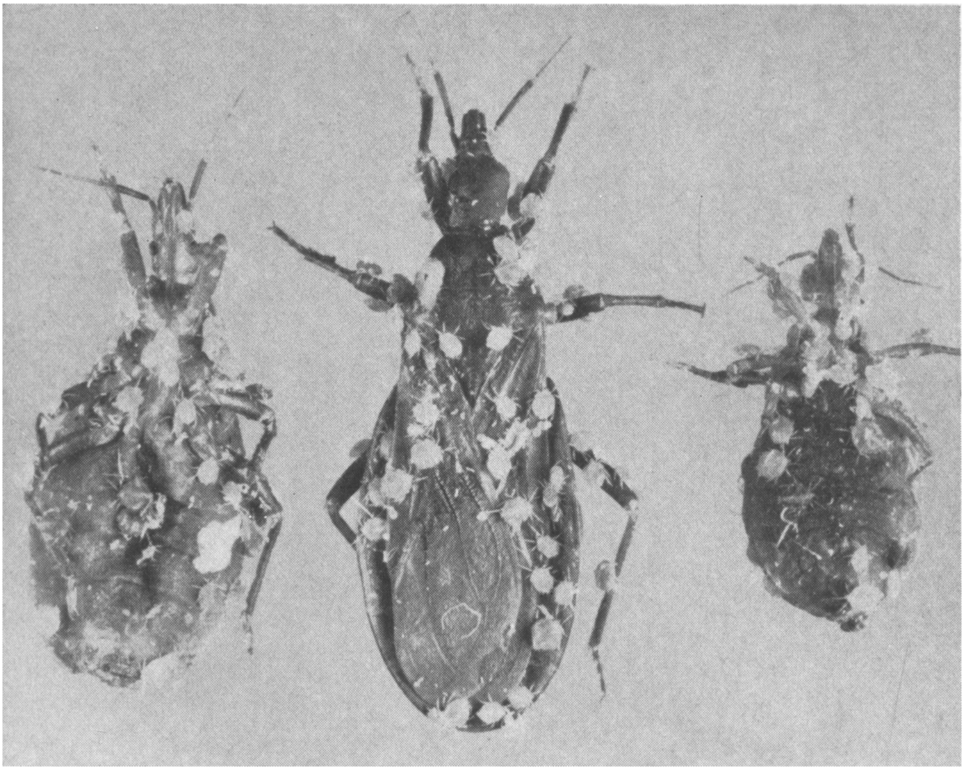


Fig. 80. A total of 282 *Pimeliaphilus gloriosus* mites were attached to the three laboratory hosts, *Triatoma protracta woodi* Usinger. In heavily parasitized colonies of kissing bugs, the mites are attached to dorsal and ventral body surfaces and to the appendages.

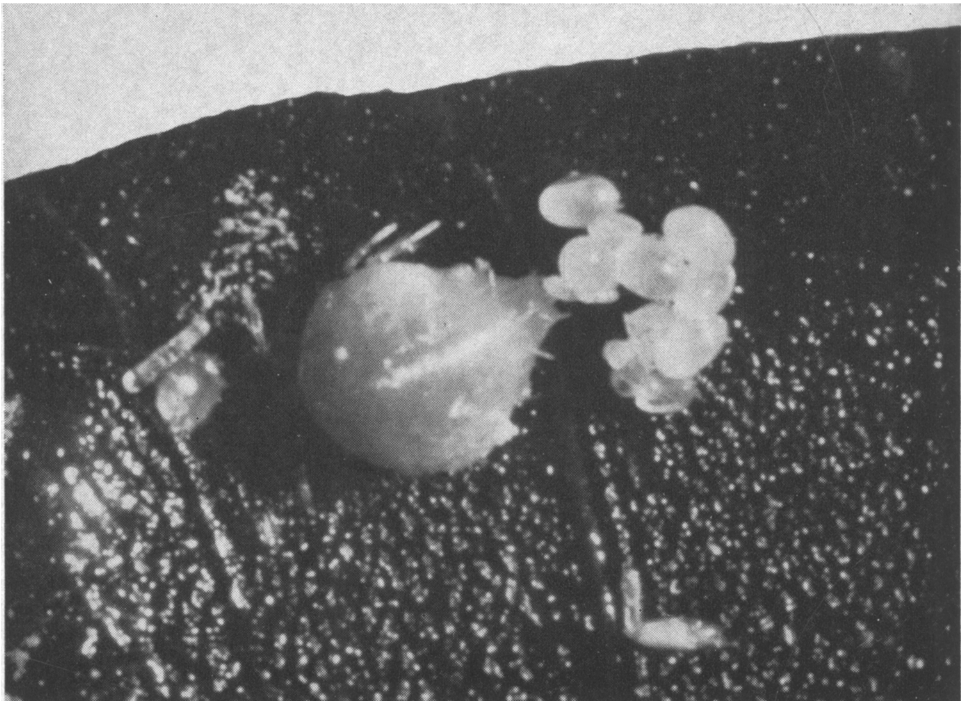


Fig. 81. *Pimeliaphilus gloriosus.* Gravid female mite with plaque of eggs, on adult of *Triatoma protracta nahuatlae* Ryckman. The gravid females remain attached at a given point under the wings of the host for most of their reproductive lives; hence the plaque of eggs behind the female. The wings of the host have been removed to expose the mites. There are several eggs behind the female mite, and a rod-shaped guanine pellet anterior to her.

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