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COPIDOGNATHUS CURTUS HALL, 1912, AND OTHER SPECIES OF *COPIDOGNATHUS* FROM WESTERN NORTH AMERICA (ACARI, HALACARIDAE)[1]

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Up to the present time, the writer has described five species of *Copidognathus* Trouessart, 1888, from western North America. In the present paper five new species are added, and in addition *Copidognathus curtus* Hall, 1912, is redescribed, making a total of 11 species of the genus known from this part of the world. Of these, 10 are from the Aleutians, Bering Sea, and Arctic Ocean, while *Copidognathus curtus* is from southern California. This probably represents about half of the species of the genus from this region.

The redescription of *Copidognathus curtus* is necessitated by the discovery of a related species from the Arctic Ocean, *Copidognathus aurorae*, new species. Both are members of a natural group which also includes *C. fabricii* (Lohmann), 1889; *C. speciosus* (Lohmann), 1893; *C. loricatus* (Lohmann), 1889; and *C. zanzibari* (Gimbel), 1919. A close relationship between *Copidognathus orientalis*, new species, and *C. poucheti* (Trouessart), 1893, from Iceland, is also evident.

The figures were drawn by the author with the aid of a camera lucida. Scales are available for most figures, and these can be used to obtain measurements not given in the text. Each subdivision of the scale equals 10 μ, so that a scale with one division represents 10 μ, one with three divisions represents 30 μ, etc. In

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the scales that are 10 divisions long, a slightly longer mark has been made at the 50-μ point.

The standard abbreviations used in the monograph on the Halacaridae of eastern North America are used here for the following frequently recurring terms:

AD, anterodorsal plate
AE, anterior epimeral plate
GA, genito-anal plate
OC, ocular plate
P-3, palpal segment three
PD, posterodorsal plate
PE, posterior epimeral plate
I-6, segment six of leg I (or tarsus I)
III-3, segment three of leg III (or femur III)

The holotypes are deposited in the collection of the American Museum of Natural History.

Copidognathus curtus Hall, 1912

Figures 1–18

The species is redescribed mainly from specimens collected at Pacific Grove, California, rather than the type locality, which was Laguna Beach. Precise topotypy is sacrificed in preference for the quality of the material, the specimens from Pacific Grove being more numerous and in better condition for study. However, the specimens from the two localities have been compared in detail and are identical.

MALE: Body 350–428 μ long, 246–311 μ wide, length/width = 1.35–1.48; average of six males from Pacific Grove, 395 by 292 μ, length/width = 1.41. AD (fig. 1) with well-formed rosette pores (fig. 15) in two groups, the posterior one much broader than long and raised above the anterior portion of the plate. First pair of dorsal setae just anterior to the raised posterior half of the plate. Second pair of dorsal setae in the membranous area between AD and OC. OC (fig. 6) with two distinct corneae surrounded by rosette pores, and sometimes with a few rosette pores near the posterior end of the plate. Third pair of dorsal setae also in the membranous area between OC and PD. Costae broad, three to five rosette pores wide, uniform in width except anteriorly where they broaden slightly and coalesce with the lateral row of rosette pores (the latter two to three pores wide). Intervening areas (fig. 16) distinctly paneled, as are those portions of OC and AD

which are not covered with rosette pores. Membranous areas broad, and with thick, anastamosing striae (fig. 14) rather than the thin parallel ones so frequently found in the genus. AE without epimeral processes.

AE, PE, and GA (fig. 12) covered with typical or nearly typical rosette pores with a distinct ostium, alveolus, and several large canaliculi (figs. 10, 11). PE with one dorsal and three ventral setae. GA (fig. 3) with 55 to 60 setae surrounding genital opening. First, second, and fourth setae of genital sclerites long, flexible; third very heavy, not flexible (fig. 7). Striae of membranous area thick, but with fewer anastamoses than on the dorsal surface. Capitulum (fig. 4) highly characteristic; palpi not reaching quite to the end of I-4, rostrum reaching just beyond the middle of P-3. Rostral sulcus 0.78 to 0.83 times as long as rostrum, first pair of long maxillary setae at, or very nearly at, the same level as the end of the sulcus. Posterior pair of maxillary setae duplicated, the four setae as shown in the figure. Base of capitulum with rosette pores. Palpi and chelicerae (figs. 5, 8) showing no special features.

CHAETOTAXY OF LEGS

	I				II				III				IV			
	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.
1	—	—	—	1	—	—	—	1	—	1	—	—	—	—	—	—
2	1	1	—	—	1	1	—	—	1	1	—	—	1	1	—	—
3	3	1	1	—	3	1	1	—	2	—	—	—	2	1	—	—
4	1	1	1	1	1	1	1	1	1	1	1	—	2	1	—	—
5	4	1	—	2	2	1	2	2	2	1	1	1	2	2	1	—
6	3	3	—	—	3	—	—	—	3	—	—	—	3	—	—	—

I-3 (fig. 17) swollen, only 1.86 times as long as high; with typical rosette pores on all but dorsal surface. I-5 with rosette pores ventrolaterally. Medial setae of I-5 unusual in that the basal one is short, flattened, and pectinate, while the distal member of this group is long, tapering, and smooth (this is true in specimens from Laguna Beach as well as Pacific Grove). I-6 with bacillum and parambulacral setae in addition to those shown in the table, and these are typical in form. II-3 and II-5 with typical rosette pores distributed as on I-3 and I-5. II-3 swollen, 1.84 times as long as high; both medial setae of II-5 short, distal half palmate and strongly pectinate. Rosette pores on lateral and ventral surfaces of III-3 and IV-3, but absent from III-5 and IV-5.

III-3 without (fig. 18), IV-3 with, ventral seta. Distimedial seta of III-5 flattened, pectinate. III-6 and IV-6 with only three setae dorsally. All tarsi with prominent claw fossa and membranes, all lateral claws distinctly pectinate and with an apparent accessory tooth. Median claws normal, bidentate, the ventral tooth distinctly longer than the dorsal.

FEMALE: No specimens were available from Pacific Grove, but one from Laguna Beach measured 421 by 305 μ, length/-width = 1.38. Resembling the male in all respects noted above except the following. Membranous areas even more extensive than in male. Anterior pair of setae of GA very near anterior margin of plate. Ovipositor reaching to a point about midway between the genital opening and the anterior margin of GA. Basal pair of maxillary setae not duplicated, but rostral sulcus as described for male. The pores on the femora and tibiae are as in the male, but the ventral seta of IV-3 is small and easily overlooked.

REMARKS: It would be impossible to place this species systematically on the basis of the very fragmentary original description and figures. However, Hall's illustration clearly showed that *C. curtus* was a relatively broad mite, and since all other species of *Copidognathus* from the two localities are narrower in form, it is unlikely that there has been any mistake in assigning Hall's name to the specimens described above. Once this has been done, it is seen that *C. curtus* is a species closely resembling *C. fabricii* (Lohmann), 1889, and certainly closely related to it. The discovery of another member of this species group in the Arctic Ocean makes it necessary to redescribe *C. curtus* in detail.

Outstanding characteristics of this species are the positions of the second and third pairs of dorsal setae (both in the membranous area), the large number of setae on GA of the male, the position of the first pair of long maxillary setae at the end of the rostral sulcus, and the duplication of the posterior pair of maxillary setae of the male.

An interesting anomaly seen in one male from Pacific Grove was the presence of a well-developed seta on P-3 of the right side (fig. 13). This is a typical seta in every respect, possessing a cuticular canal, alveolus, and tapering hollow shaft, and is medial in position as in species of other genera. However, it is found only on the right side of an otherwise normal specimen. Its origin is uncertain, for the setae of P-4 and P-2 are present and normal, but

it may have arisen as a duplication of one of these, the trichogen and tormogen having been displaced into P-3. Or, what is much less likely, it may be the expression of a potentiality which is normally suppressed in the species of this genus but which is characteristic of the closely related genus *Agauopsis* in which P-3 bears a medial or dorsal seta. This is the only anomaly of the kind known to the writer. The seta is not optically active, but neither is the seta of P-3 of species of *Agauopsis*.

DISTRIBUTION: Pacific Grove, California, (latitude 36° 39′ N., longitude 121° 53′ W.); Laguna Beach, California (latitude 33° 35′ N., longitude 117° 45′ W.); Borys Malkin.

Copidognathus aurorae, new species

Figures 19–30

FEMALE: The single female from the type locality measured 603 by 415 μ, length/width = 1.45. AD (fig. 21) with three separate areas of rosette pores, the posterior two not coalesced as in *C. curtus*. Second and third pair of dorsal setae in the membranous area. OC as shown in figure 28, corneae present. Costae two to three rosette pores wide (fig. 25), slightly expanded anteriorly; remainder of plate paneled, several canaliculi opening into the floor of each panel. Membranous area hirsute, the hairs very slender, and up to 12 μ in length. Ventral plates (figs. 30, 32) rather uniformly covered with porose panels, except in the vicinity of the epimeral pores, the setae of AE and a band across the anterior half of GA where the panels are evanescent. GA, PE, and AE with patches of rosette pores in the usual positions, the pores having gaping ostia and numerous canaliculi. Epimeral processes absent from AE. Ovipositor (fig. 30) scarcely extending beyond the genital opening. Palpi (fig. 19) more slender than in *C. curtus*, the rostrum, despite its great length, reaching only a little beyond the end of P-3. Rostral sulcus 0.83 as long as rostrum, third (first long) pair of maxillary setae behind the end of the sulcus. Rostrum very long, twice or more than twice as long as the interval between the fourth pair of setae. Base of capitulum marked with prominent porose panels which appear to grade into rosette pores laterally; cuticle hirsute. Legs (figs. 22–24) also hirsute, femora paneled, but lacking the rosette pores found in *C. curtus*. I-3 and II-3 approximately twice as long as high, but no specimen was available for dissection; I-5 very long, slender, three times as long as high. Number of setae

for each segment as given for *C. curtus;* IV-3 with one ventral seta, III-6 and IV-6 with three dorsal setae. Cuticle of all segments with numerous canaliculi. Claw fossa present, but weakly developed on all tarsi. Lateral claws pectinate and with an apparent accessory tooth. Median claw large, bidentate.

MALE: Body 538–551 μ long, 376–402 μ wide, length/width = 1.37–1.47 (three specimens). Resembling the female in all respects except the characters of GA (figs. 26, 29). Anterior half of GA appearing slightly cinctured. Genital opening with 20 to 24 setae on each side (three specimens). Setae of genital sclerites (fig. 29) as in *C. curtus*, the first, second, and fourth pairs long, flexible, tapering, the third pair spiniform. Capitulum with only four pairs of setae.

REMARKS: The species resembles *C. curtus* Hall, 1912, and is obviously closely related to it. Many differences exist, however, and it is felt that the creation of a discrete species for the Arctic forms expresses more accurately the relative systematic position of the two populations than would the erection of a subspecies. The new species is considerably larger than *C. curtus*, which is the rule with species groups occupying both arctic and temperate waters. The characters of AD, the absence of rosette pores from the femora, and the non-duplication of the fourth pair of maxillary setae of the male are constant characters which serve to differentiate the species. The close relationship between the two species is demonstrated clearly by the position of the third dorsal setae in the membranous area, the form of the rostrum, the position of the third pair of maxillary setae with respect to the rostral sulcus, the large number of setae around the genital opening of the male, the unusual form of the setae of the genital sclerites, and the form of the ovipositor.

Copidognathus curtus Hall and *C. aurorae*, new species, show unquestionable affinities with *C. speciosus* (Lohmann), 1893, and *C. fabricii* (Lohmann), 1889. The general facies of all four species is similar, and the position of the third dorsal setae in the membranous area strongly suggests a relationship. Included in this group also is *C. loricatus* (Lohmann), 1889, judging from Lohmann's description and notes, and probably *C. zanzibari* (Gimbel), 1919. These six species form an easily recognized, cosmopolitan group within the genus *Copidognathus*, characterized by the presence of the third dorsal setae in the membranous area, a usually parallel-sided rostrum, a ventral seta on leg IV of all

adequately illustrated species, and a large number (40 to 65) of setae surrounding the male genital opening of perhaps all species. Also, the third pair of maxillary setae is displaced posteriorly, lying at the end of the sulcus in *C. fabricii* (see Lohmann, 1889, fig. 81, not 1893, pl. 8), *C. curtus*, *C. aurorae*, and perhaps the others as well. Principal variations within this group appear to be the rosette pores on I-3 and I-5 (present in *C. curtus*, *C. speciosus;* absent in *C. fabricii*, *C. aurorae*), the number of dorsal setae on III-6 and IV-6 (three in *C. curtus*, *C. aurorae*, *C. loricatus;* four in *C. fabricii*), the distribution of rosette pores of AD, and the degree of development of the claw fossae. Other differences could probably be found if all species were adequately known.

DISTRIBUTION: Arctic Ocean, 18 miles northwest of Wainwright, Alaska (latitude 70° 53′ N., longitude 160° 05′ W.), male holotype. Sand and gravel bottom at depth of 130 feet. I. M. Newell.

Copidognathus dianae, new species

Figures 31–46

This species is described from specimens collected 1.5 miles northeast of Alexai Point, Attu Island, Alaska, the type locality.

FEMALE: Body (fig. 34) 402–441 μ long, 272–292 μ wide, length/width = 1.44–1.51; average 421 by 285 μ, length/width = 1.47 (three specimens). Rosette pores of AD (fig. 35) not borne on discrete circular or oval areas but along the margins of the nearly semicircular raised posterior portion of the plate. Center of posterior elevated area slightly sunken, marked with depressed porose panels or with simple depressed panels with a very few minute and scattered canaliculi. First pair of dorsal setae small, lying at the ends of the two rows of rosette pores, the latter being partially coalesced anteriorly. Second pair of setae in the membranous area, third in PD. OC with two areas of rosette pores (fig. 33), the canaliculi very minute; remainder of plate sharply paneled. Costae of PD two to three rosette pores wide, the pores (fig. 41) typical in form. Area outside of costae strongly paneled, the panels with a few scattered pores opening into the floor. Dorsal membranous area of moderate extent, marked with thin, parallel striae. Ventral plates (fig. 36) marked with distinct porose panels (fig. 32). Epimeral processes well developed. GA appearing somewhat cinctured just anterior to the

middle of the plate. Genital opening displaced far posteriorly; ovipositor not quite reaching to the middle of the interval between the anterior margin of GA and the genital opening. A patch of rosette pores on each side of the genital opening.

Rostrum (fig. 40) not reaching to level of distidorsal end of P-2, 1.84 to 1.96 times as long as the interval between the fourth (second long) pair of maxillary setae. Rostral sulcus 0.60 to 0.65 times as long as rostrum, third (first long) pair of maxillary setae 0.22 to 0.24 times the length of the sulcus from the posterior end of the sulcus (average indices for three specimens: 1.88, 0.62, 0.23). Palpi and chelicerae as shown in figures 43 and 44. Chelicerae relatively small in comparison with other species of similar body size. Base of capitulum with two indistinct areas of rosette pores, their indistinctness due to the rough sculpturing of the base, which extends even onto the rostrum.

Number and arrangement of setae the same as given in the table for *C. propinquus*, new species. All segments of legs rough except the tarsi, the femora especially roughly paneled. Femora I and II greatly swollen, only 1.34 and 1.58 times as long as high, respectively (figs. 37, 38). First and second dorsal setae of III-6 not close together, the distance from the base of the segment to the level of the first seta being only about 1.4 times as great as the distance from the first seta to the level of the second (fig. 46). All tarsi with distinct claw fossa and lamellae, all lateral claws pectinate and with an apparent accessory tooth, median claw bidentate.

MALE: Body 369 by 259 μ, length/width = 1.42 (one specimen). Resembling the female in all other respects except the characters of GA (fig. 45). GA distinctly paneled and with two areas of rosette pores as in female. Genital opening surrounded by about 35 setae, 15 to 20 on each side (three specimens had 33, 35, 38 setae). Setae of genital sclerites all short and inflexible, but the first and second pairs much more slender than the third and fourth (fig. 31).

REMARKS: This species, named for my daughter, keys out to *C. glyptoderma* (Trouessart), 1888, in Viets' key (1940, p. 17), but differs appreciably from the figures given by Trouessart (1901, pl. 4) under that name. There is no certainty, however, that the mite described by Trouessart in 1888 and that in 1901 are one and the same species. In fact, there is some evidence that they may not be, for he pointed out (1901, p. 260) that he

had two groups of specimens from Henri Gadeau de Kerville's 1899 collection, one in which there was a distinct claw fossa with lamellae, the other in which there evidently were no lamellae present on III-6. "Les spécimens de l'Océan (Marennes, Arcachon), tous femelles, n'ont qu'une simple échancrure à la place de cette gouttière, bien marquée sur le spécimen mâle de Granville." In the writer's experience, the absence of lamellae is a significant character and furthermore has not yet been found to be restricted to one sex of a species.

DISTRIBUTION: Attu Island, Aleutian Islands, Alaska, 1.5 miles northeast of Alexai Point, female holotype. Intertidal, on algae and in coarse sand. I. M. Newell.

Copidognathus orientalis, new species

Figures 47–62

The following description is based on specimens from Attu Island, Aleutian Islands, Alaska.

MALE: The only specimen available for measurement was 428 by 318 μ, length/width = 1.35. AD (figs. 47, 62) with a Y-shaped area of typical rosette pores, the arms of the Y nearly parallel posteriorly, converging anteriorly. Setae just anterior to the confluence of the arms of the Y, and unusually close together (six specimens of both sexes checked). OC (fig. 49) with two areas of rosette pores, corneae indistinct, eye spot brilliant carmine red in Hyrax-mounted specimens. Second seta anterior to OC, third seta in PD. Costae of PD broad, three to five rosette pores wide (fig. 57). A lateral row of a few irregular rosette pores is found at the very margin of the plate, and may be imperceptible in some specimens. Remaining portions of dorsal plates, outside of areas covered by rosette pores, distinctly paneled, three to 10 small canaliculi opening into the floor of each panel. Membranous area greatly reduced, marked by striae which are mostly parallel, but showing a few anastamoses. Ventral plates (figs. 50, 55) covered with pronounced porose panels; with areas of rosette pores anterior to the insertions of legs II, III, and IV, and lateral to the genital opening. Penis large, extending nearly to anterior end of GA. Genital opening surrounded by 12 to 15 setae on each side. Genital sclerites well sclerotized. First and second pairs of genital setae thick basally, but tapering to a long, slender, and flexible tip; third

pair slender and spiniform, fourth pair not so heavy as the third, and appearing flexible distally.

Rostrum (fig. 52) reaching nearly to level of dorsal end of P-2, length 1.67 to 1.83 times the interval between the fourth pair of maxillary setae (two males, one female). Rostral sulcus 0.56 to 0.68 times the length of the rostrum, third pair of maxillary setae at or very near the end of the rostral sulcus, 0.00 to 0.04 times the length of the sulcus from the end of the sulcus (the setae may actually lie behind the end of the sulcus). Palpi as shown in figure 53; terminal seta unusually heavy (figs. 54, 58, female). Base of capitulum with two areas of rosette pores. Number and distribution of setae of legs precisely as given in the table for *C. propinquus*, new species. I-3 and II-3 greatly swollen, 1.52 and 1.61 times as long as high, respectively. All femora coarsely paneled (figs. 60, 61) and other segments with numerous scattered pores. First two dorsal setae of III-6 close together, the distance from the base of the tarsus to the first seta being 3.5, 3.7, 4.2, 5.8, and 6.7 times as great as the distance from the first seta to the level of the second in the five specimens examined (both male and female). All tarsi with prominent claw fossa and membranes, lateral claws distinctly pectinate, median claw bidentate.

FEMALE: Body 421 to 454 μ long, 279 to 318 μ wide, length/-width = 1.37 to 1.52; average of three specimens, 434 by 298 μ, length/width = 1.47. Resembling male in all other respects except characters of GA. Genital opening almost rectangular anteriorly (fig. 56); ovipositor short, reaching only about to level of most anterior pair of setae of GA. Paneling of plates as in male.

REMARKS: This species appears to be similar to *C. poucheti* (Trouessart), 1893, from Iceland,[1] but it is not possible to tell from the original description and figures whether they are the same or not. Points of resemblance are the broad form of the body, the wide convergent costae, the form of the porose area of AD, and the rectangular form of the genital opening of the female. However, there are numerous critical characters which were not treated by Trouessart, and since minor differences appear to exist, it is likely that these are separate, though certainly very closely related species.

[1] The writer (1947, pp. 132, 160) erroneously gave Spitzbergen as the source of the type material. Actually it came from Iceland, and the species is unknown from Spitzbergen

DISTRIBUTION: Attu Island, Aleutian Islands, Alaska. About 1 mile west of Murder Point (latitude 52° 48′ N., longitude 173° 10′ E.), female holotype. Intertidal, on coralline algae. I. M. Newell.

Copidognathus propinquus, new species

Figures 63–77

This species is described entirely from material from Kagamil Pass, the type locality.

FEMALE: Body (fig. 75) 363–395 μ long, 220–240 μ wide, length/width = 1.62–1.70; average 382 by 233 μ, length/width = 1.66 (three specimens). AD (fig. 64) with rosette pores arranged in the form of a crescent, not in discrete circular or oval areas as in many species of the genus. Setae difficult to discern against the background of prominent pores and panels, but lying anterior to the semicircular elevated portion of the plate around the edge of which are found the rosette pores. Second pair of dorsal setae in the membranous area, third pair in PD. OC with two areas of rosette pores (fig. 68), one near the shrunken and scarcely visible corneae, the other along the posterolateral angle of the plate. Costae of PD with typical rosette pores (fig. 67). A second row of rosette pores near the margins of PD is visible in glycerine dissections, but is virtually indistinguishable in Hyrax whole mounts because of the curvature of the plate and the obliterative effect of the heavy paneling of the plate. Panels very prominent, each with a few (three to eight) small pores opening into the floor of the panel.

Paneling of ventral surface (fig. 66) much less distinct than that of dorsal surface, rather rough in appearance, a number of distinct canaliculi in each panel. Epimeral processes of AE very large. Genital opening displaced posteriorly; ovipositor not reaching to the middle of the interval between the anterior end of GA and the genital opening. An area of typical rosette pores on each side of the genital opening, and two on PE, anterior to the insertions of legs III and IV. Membranous areas of both dorsal and ventral surfaces greatly restricted.

Rostrum (fig. 65) reaching nearly to level of end of P-2. Rostral sulcus about 0.60 to 0.65 times as long as rostrum, third (first long) pair of maxillary setae 0.25 to 0.27 of the length of the sulcus from the posterior end of the sulcus (two specimens). Palpi

and legs as in male (figs. 71, 72, 73, 77). Base of capitulum rough and with two areas of rosette pores.

MALE: The only male available for measurement is 338 μ long. Resembling the female in all respects except the characters of GA (fig. 63). Genital opening with only 10 to 12 setae on each side. Genital sclerites (fig. 70) heavily sclerotized and punctate, all setae short and spindle-shaped, the third and fourth pairs especially heavy. Penis occupying 0.8 of the interval between the genital opening and the anterior margin of GA.

CHAETOTAXY OF LEGS

	I				II				III				IV			
	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.	d.	v.	l.	m.
1	—	—	—	1	—	—	—	1	—	1	—	—	—	—	—	—
2	1	1	—	—	1	1	—	—	1	1	—	—	1	1	—	—
3	3	1	1	—	3	1	1	—	2	—	—	—	2	—	—	—
4	1	1	1	1	1	1	1	1	1	1	1	—	2	1	—	—
5	3	1	1	2	3	1	1	2	2	2	1	—	2	2	1	—
6	3	3	—	—	3	—	—	—	4	—	—	—	3	—	—	—

Legs rather rough looking, especially I-3 and II-3 which are paneled and porose (fig. 72). Ventral margin of I-3 appearing finely serrate in lateral view. I-3 and II-3 greatly swollen, 1.43 and 1.54 times as long as high, respectively. III-3 and IV-3 with only the two dorsal setae. III-6 with four, IV-6 with three setae dorsally. The two setae between the base of III-6 and the claw fossa very close together, the distance from the base of the segment to the level of the first seta being five to seven times as great as the distance from the first seta to the level of the second. All tarsi with claw fossa and lamellae, all lateral claws pectinate and with an apparent accessory tooth. Median claw bidentate and normal in form. In addition to the setae shown in the table, the usual bacillum and parambulacral setae are found on the tarsi and are of normal form.

REMARKS: The close approximation of the dorsal setae proximal to the claw fossa of III-6 provides the inspiration for the name of this species. Little, if any, attention has been paid to the value of this character in the past, although studies by the writer indicate that it is a highly reliable one. In the majority of *Copidognathus* species with four dorsal setae on III-6, the distance from the base of the tarsus to the level of the first seta is only equal to, or no more than, twice the distance from the first

seta to the level of the second. In a few, however, including *C. punctatus* Newell, 1950, and *C. hummelincki* Viets, 1936, the ratio of these distances is of the order of 3:1 or higher. Variability in this character is surprisingly low. In the case of *C. hummelincki*, the close approximation of the setae is found not only in specimens from Bonaire and Aruba (Dutch West Indies) but also in those from Miami, over 1200 miles to the northwest. In *C. punctatus* the character is constant throughout the vast stretch from Kodiak to Attu, a distance of more than 1500 miles. Here it serves as a positive means of differentiating between *C. punctatus* and occasional weakly paneled forms of *C. parapunctatus* Newell, 1950, which are sometimes difficult to separate at first glance.

DISTRIBUTION: Kagamil Pass, Islands of the Four Mountains, Aleutian Islands, Alaska (latitude 52° 56′ N., longitude 169° 44′ W.), male holotype. Boulder and gravel bottom at 245 feet depth. I. M. Newell.

Copidognathus vulcanis, new species

Figures 78–91

The following description is based entirely on specimens from Kagamil Pass, Islands of the Four Mountains, Alaska, the type locality.

MALE: Body (fig. 82) averaging somewhat larger than that of female in the series examined, 330–356 μ long, 181–194 μ wide, length/width = 1.74–1.90; averages of six specimens 343 by 188 μ, length/width = 1.82. Outline of body characteristically inflected just anterior to the anal papilla. AD (fig. 86) with an inverted U- or broad V-shaped area of prominent panels and canaliculi. The latter, although not strictly confined to the periphery of the panels, are best developed and most numerous there. Similar panels and canaliculi on the small anteromedian elevated area. Dorsal setae generally of unusual length, and never very short. Second pair of dorsal setae in the membranous area; third, fourth, and fifth pairs in PD. OC as shown in figure 83, panels and canaliculi like those on AD. PD with distinct costae (fig. 88) bearing a row of rather crudely formed porose panels with canaliculi of the type found on AD. Just lateral to the costae, especially in the middle third, is a row of irregularly spaced, coarse pores. Area between and lateral to costae distinctly paneled and

with numerous cuticular canals, the latter being especially variable in size, occasionally very small and indistinct. Venter as in female (fig. 89) except for characters of GA (figs. 78, 90, 91), plates faintly paneled and porose, the panels being most distinct lateral to the genital opening. Rosette pores absent, 10 to 12 setae on each side.

Rostrum (fig. 87) not reaching to end of P-2. Rostral sulcus 0.57 to 0.65 times as long as rostrum (average of three males, 0.62), first pair of long maxillary setae 0.24 to 0.30 of the length of the sulcus from the posterior end of the sulcus (average 0.27). Palpi as shown in figure 85.

Number of setae on legs precisely as given for *C. propinquus*, new species. I-3 and II-3 1.80 and 1.61 times as long as high (one specimen), distinctly paneled, the panels large in size (figs. 79, 81). III-6 with four, IV-6 with three, setae dorsally. III-3 and IV-3 with only the two dorsal setae and no ventral seta. Lateral claws usually, but not always, clearly pectinate; with an apparent accessory tooth. Median claw bidentate. All tarsi with a distinct claw fossa and lateral membranes.

FEMALE: Resembling the male in most respects except the characters of GA. Body 350 μ long, 201 μ wide, length/width = 1.74 (2 specimens). Ventral surface as shown in figures 84 and 89.

REMARKS: This species is similar to *C. punctatus* Newell, 1950, and *C. parapunctatus* Newell, 1950, but can always be recognized on the basis of the characteristic paneling of AD as well as the other plates. There are other differences too. For instance, I-3 is relatively more slender than II-3 in *C. vulcanis*, new species, whereas in *C. punctatus* the reverse is true. Also, the exceptionally long dorsal setae appear to be consistently longer than in either of the other two species, and in most cases are very considerably longer. However, these are somewhat variable in actual length, and their apparent length is also affected by the degree of recumbence of the setae.

In certain smaller specimens the median angle of OC is sharp, projecting into the membranous area between AD and OC. In these small forms, the paneling of AD extends to the margin of the plate, while in the larger ones there is a distinct unpaneled margin (fig. 86). Also, the third setae of AE are distinctly set back from the margin in most small forms. The ovipositor in large specimens extends appreciably beyond the first pair of setae of GA, whereas in most small ones it extends only to this level. How-

ever, these variants apparently are not consistently linked, but rather form a partial *mélange*. While the occurrence of marked variations in a number of characters like this has probable evolutionary significance, the writer considers it inadvisable at present to make a further systematic subdivision in view of the apparently incomplete segregation of the variants among the members of the population. The above diagnosis, however, has been based entirely upon the larger forms, to avoid any confusion should study of additional material show that the small forms are in reality a distinct species.

DISTRIBUTION: Kagamil Pass, Islands of the Four Mountains, Alaska (latitude 52° 56′ N., longitude 169° 44′ W.), male holotype. Boulder and gravel bottom at 245 feet depth. I. M. Newell.

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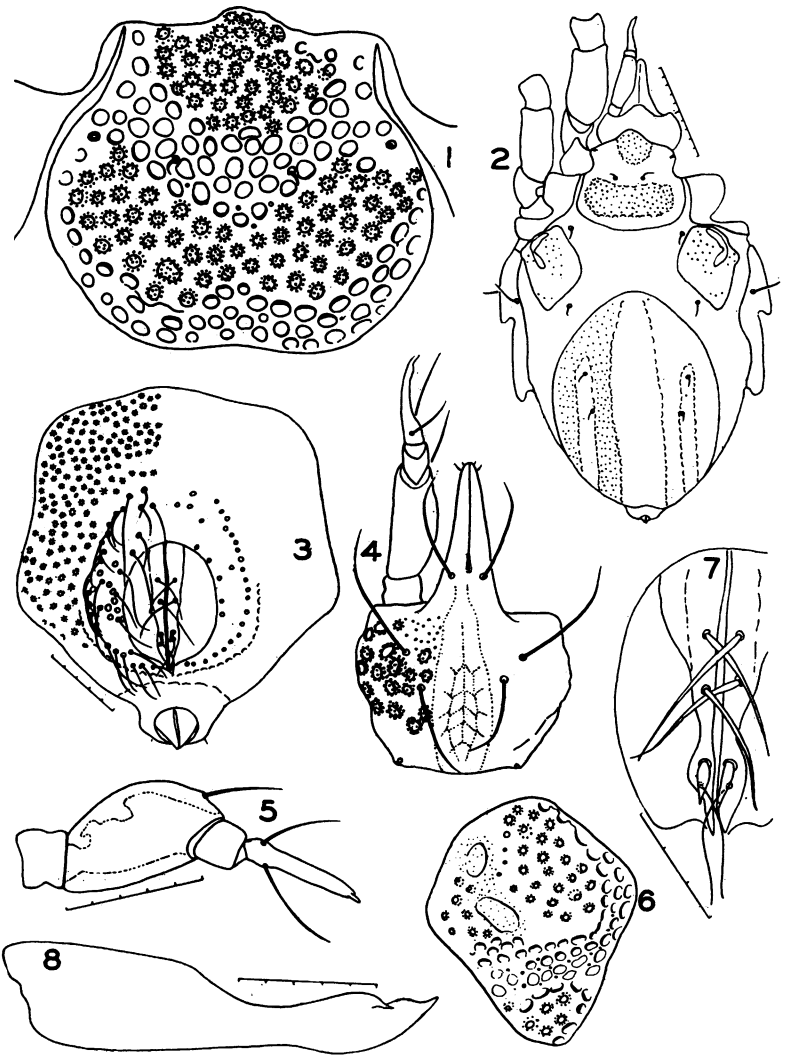
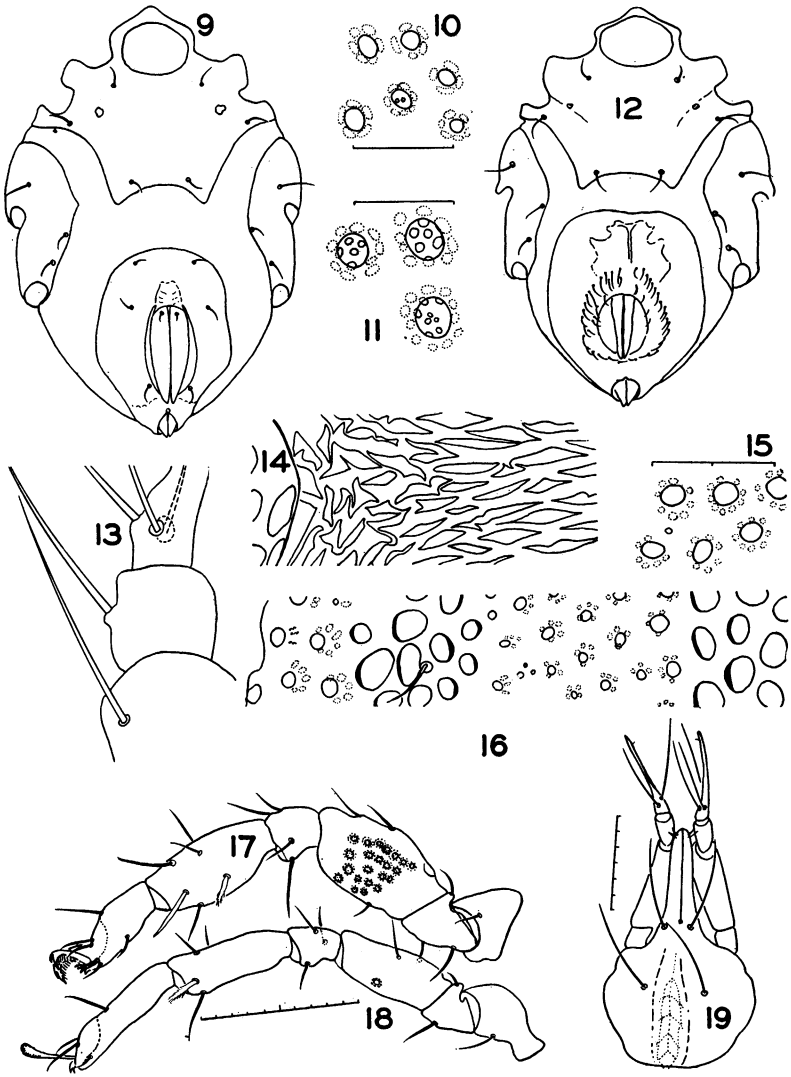
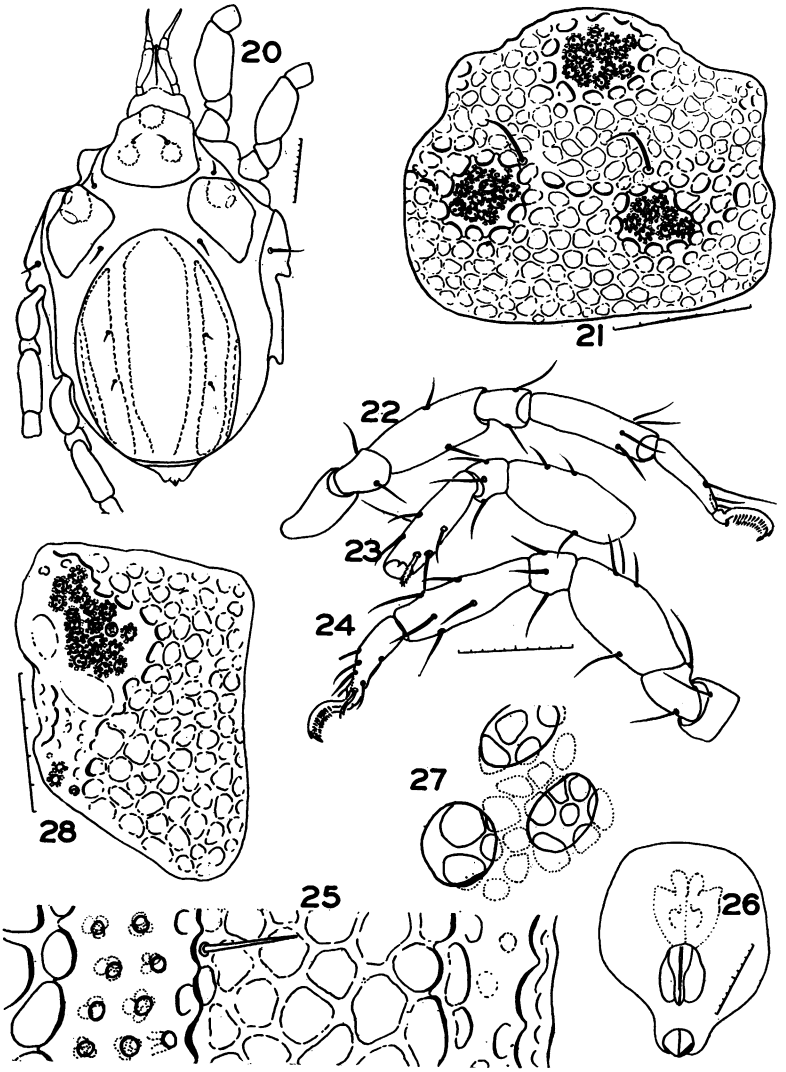


FIGS. 1–8. *Copidognathus curtus* Hall. 1. Male, AD. 2. Male, dorsum. 3. Male, GA. 4. Male, capitulum. 5. Male, palp. 6. Male, OC, dissected. 7. Male, genital opening. 8. Male, chelicera.

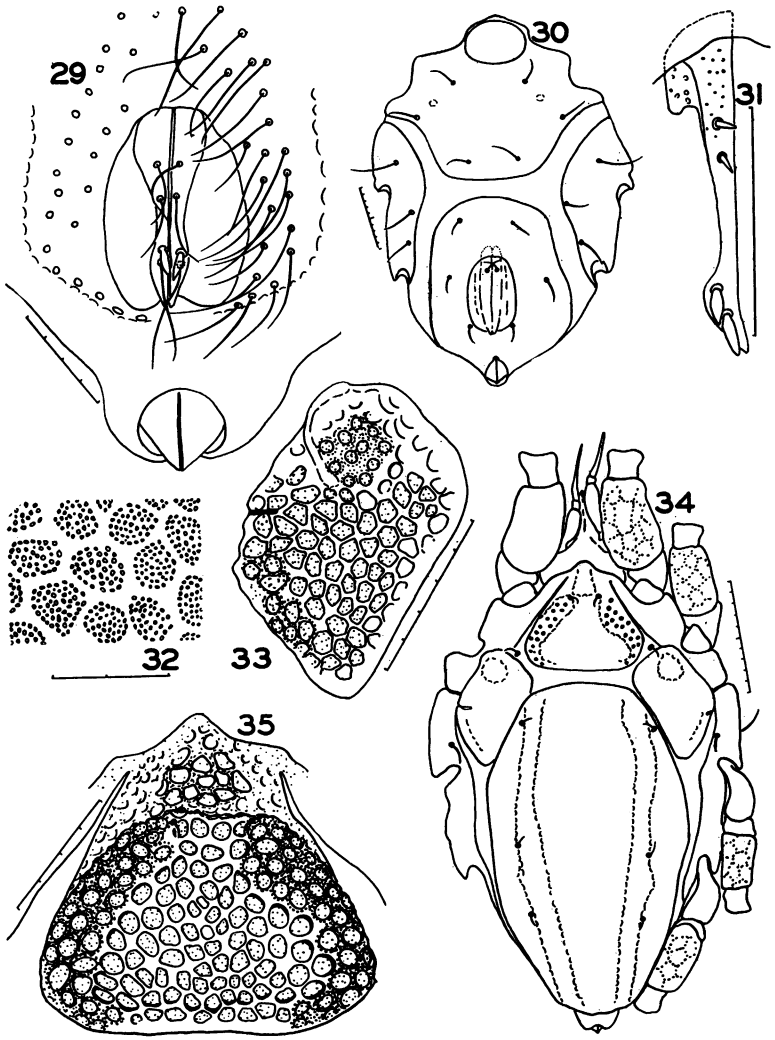


FIGS. 9–18. *Copidognathus curtus* Hall. 9. Female, venter. 10. Male, pores near center of AE. 11. Male, pores behind anterior setae of AE. 12. Male, venter. 13. Anomalous P-3 of a male from Pacific Grove, dorsal view. 14. Male, membranous area. 15. Male, rosette pores of AD. 16. Male, PD, at level of fourth dorsal seta. 17. Male, leg I, medial view. 18. Male, leg III, medial view.

FIG. 19. *Copidognathus aurorae*, new species. Female, capitulum.

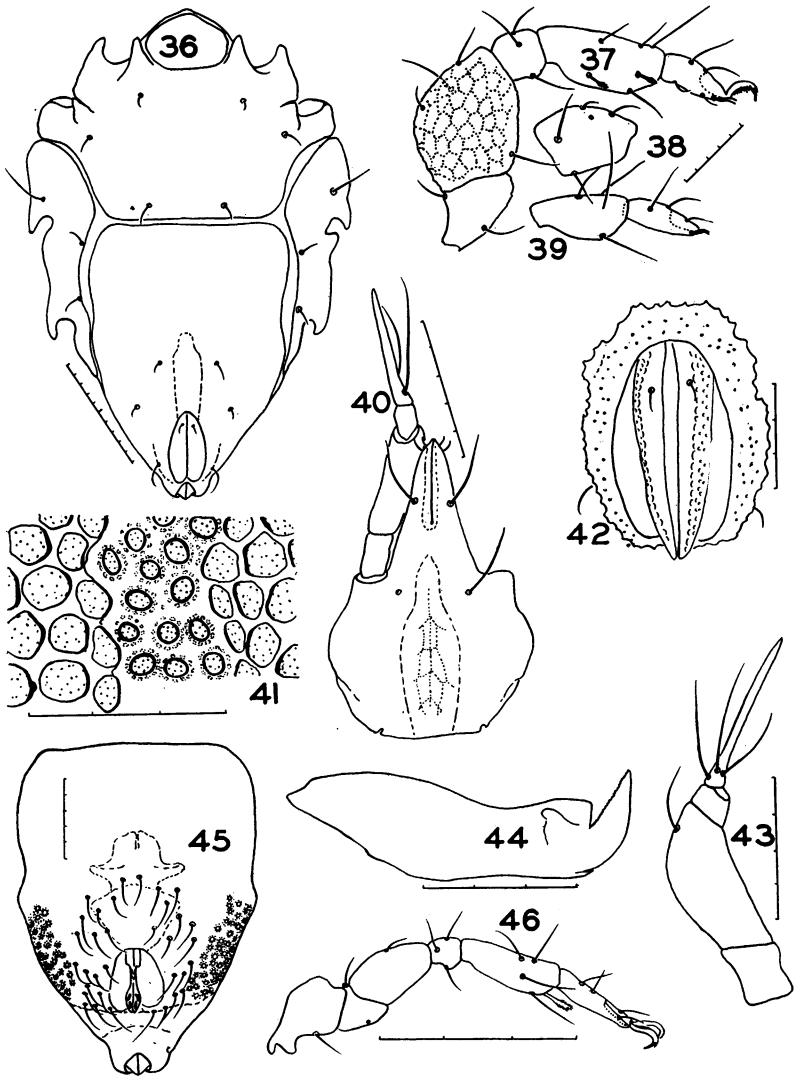


FIGS. 20–28. *Copidognathus aurorae*, new species. 20. Female, dorsum. 21. Female, AD. 22. Female, leg IV, ventromedial view. 23. Female, leg II, medial view. 24. Female, leg I, medial view. 25. Female, PD, at level of fourth dorsal seta. 26. Male, GA. 27. Female, rosette pores of OC, same scale as figure 58. 28. Female, OC.

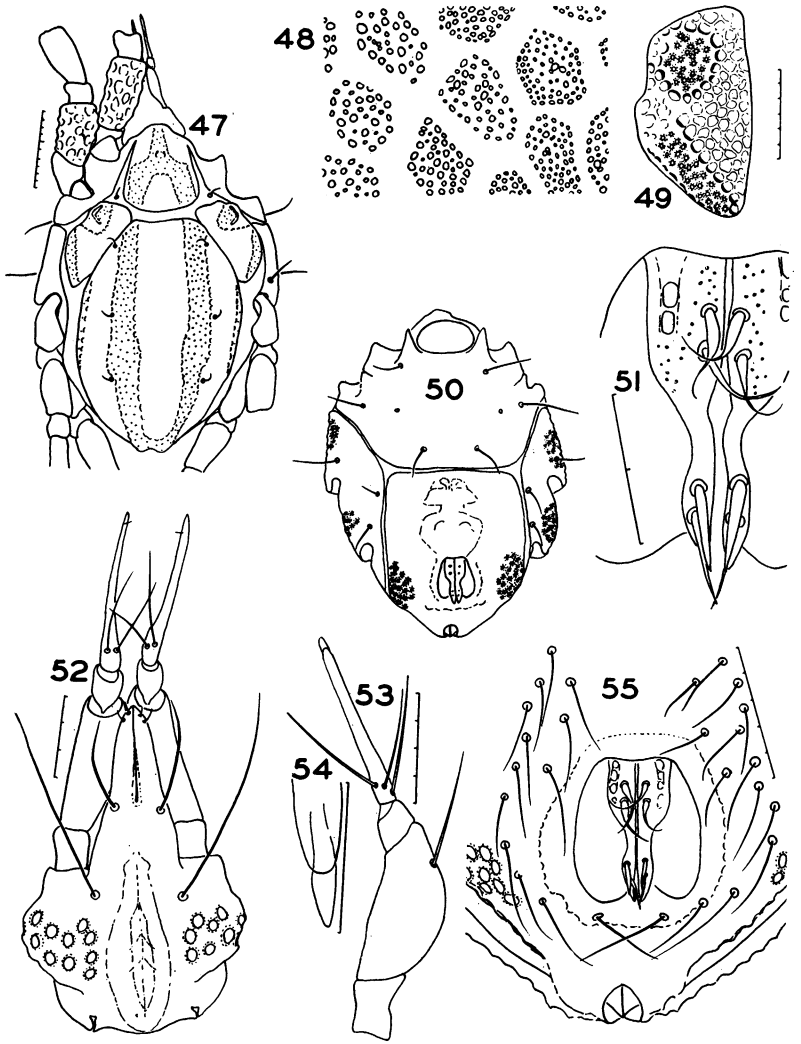


FIGS. 29–30. *Copidognathus aurorae*, new species. 29. Male, GA. 30. Female, venter.

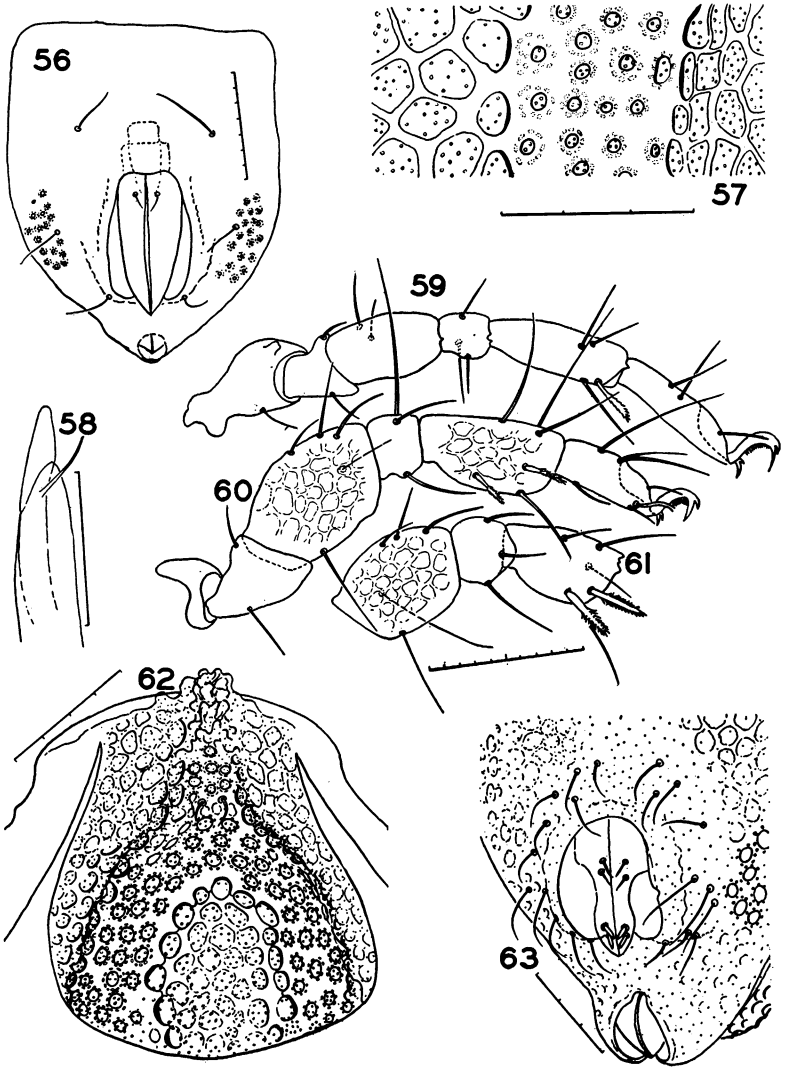
FIGS. 31–35. *Copidognathus dianae*, new species. 31. Male, genital sclerite. 32. Female, panels on AE. 33. Female, OC, dissected. 34. Female, dorsum. 35. Female, AD.



FIGS. 36–46. *Copidognathus dianae*, new species. 36. Female, venter. 37. Female, leg I, medial view. 38. Female, II-3. 39. Female, II-5, 6. 40. Female, capitulum. 41. Female, costa of PD. 42. Female, genital opening. 43. Female, palp. 44. Male, chelicera. 45. Male, GA. 46. Female, leg III, lateral view.

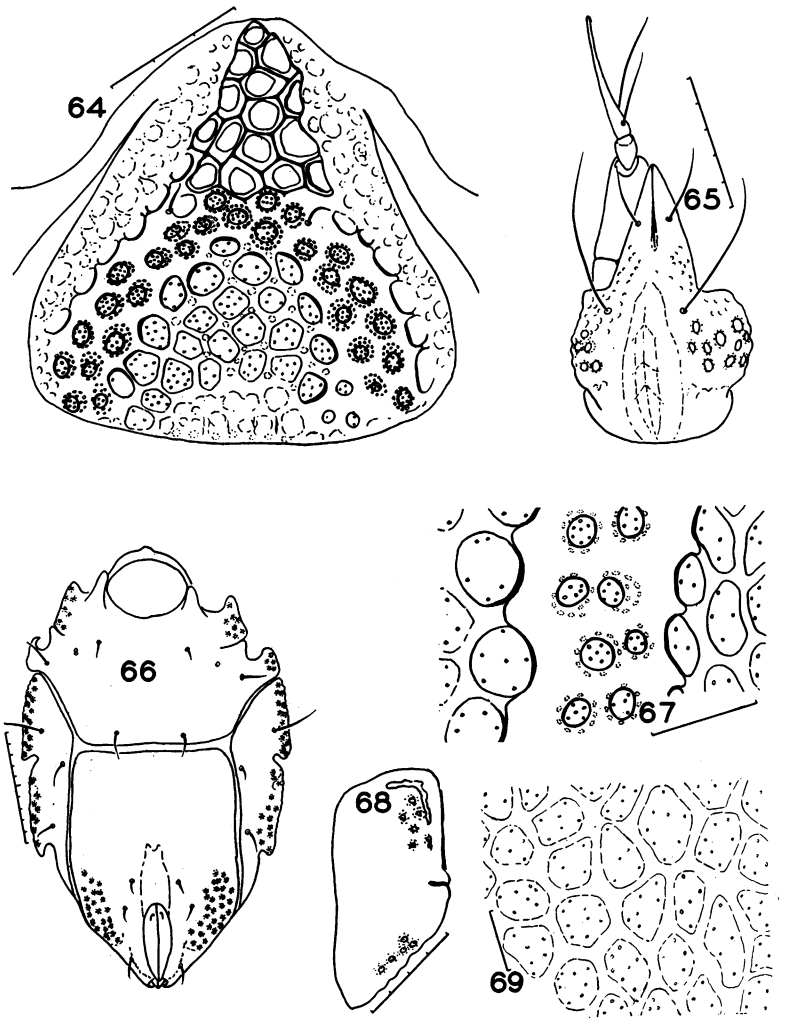


FIGS. 47–55. *Copidognathus orientalis*, new species. 47. Male, dorsum. 48. Male, AE. 49. Male, OC, dissected. 50. Male, venter. 51. Male, genital opening. 52. Male, capitulum. 53. Male, palp. 54. Male, tip of P-4. 55. Male, genital opening.

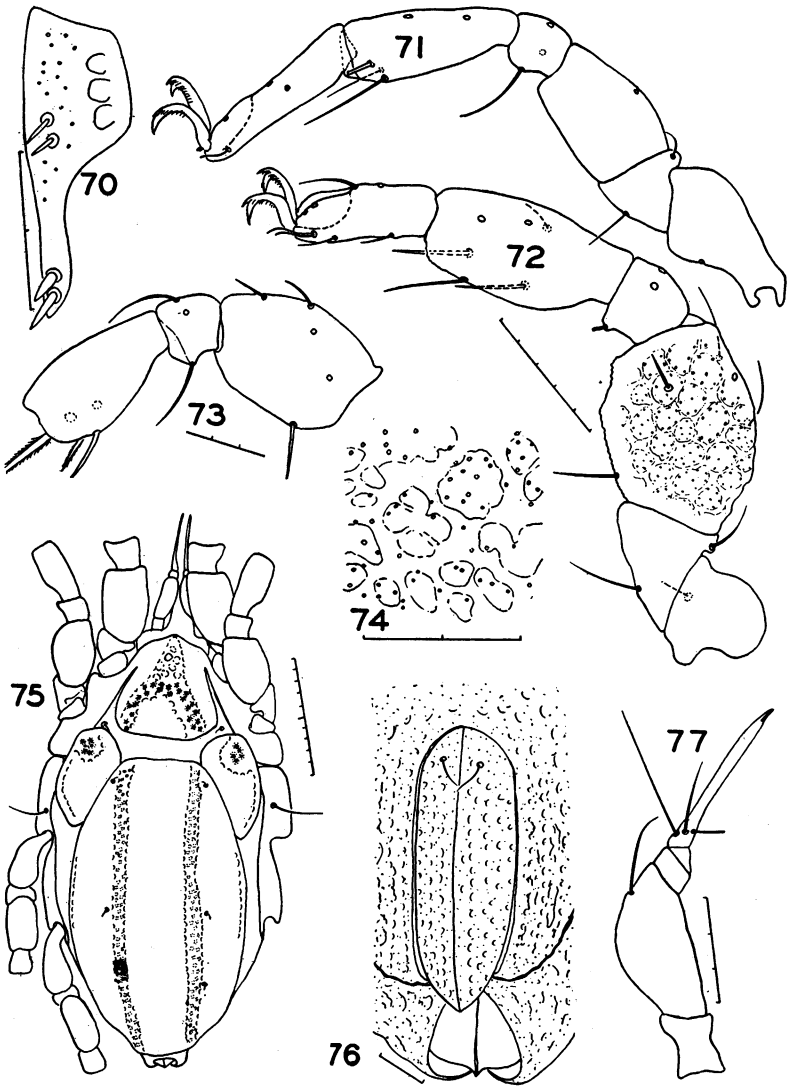


FIGS. 56–62. *Copidognathus orientalis*, new species. 56. Female, GA. 57. Male, costa of PD. 58. Female, tip of P-4. 59. Male, leg III, medial view. 60. Male, leg I, medial view. 61. Male, leg II, medial view. 62. Male, PD.

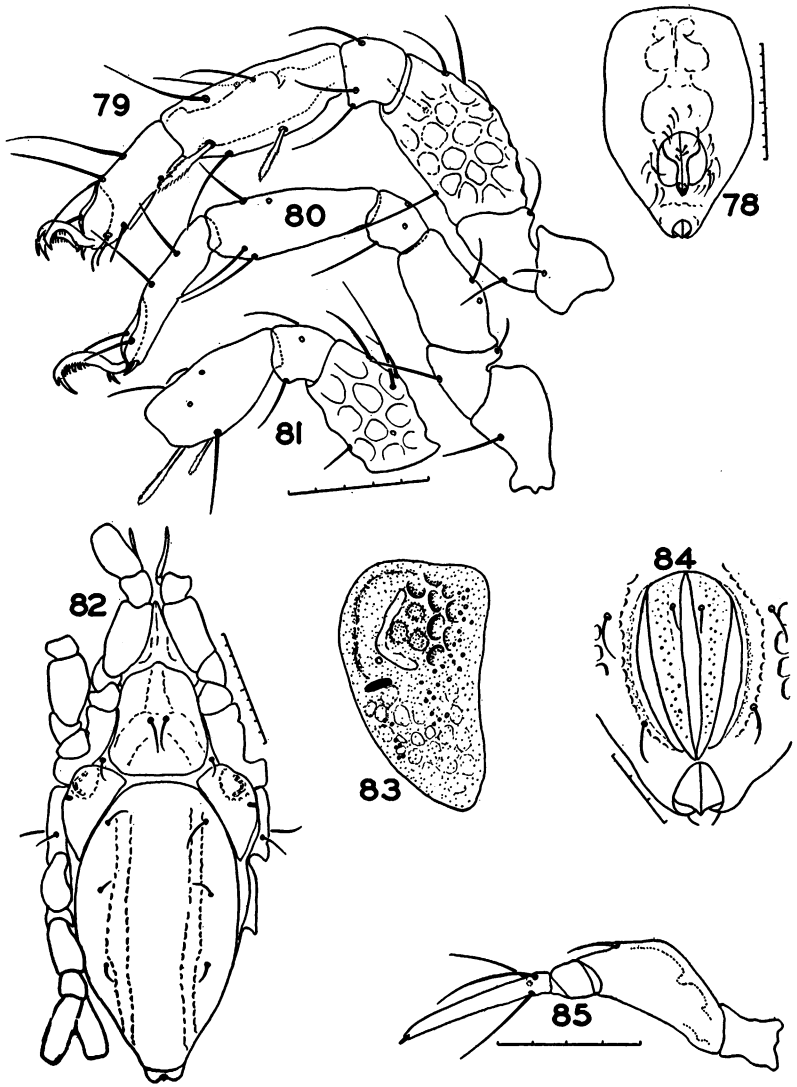
FIG. 63. *Copidognathus propinquus*, new species. Male, GA.



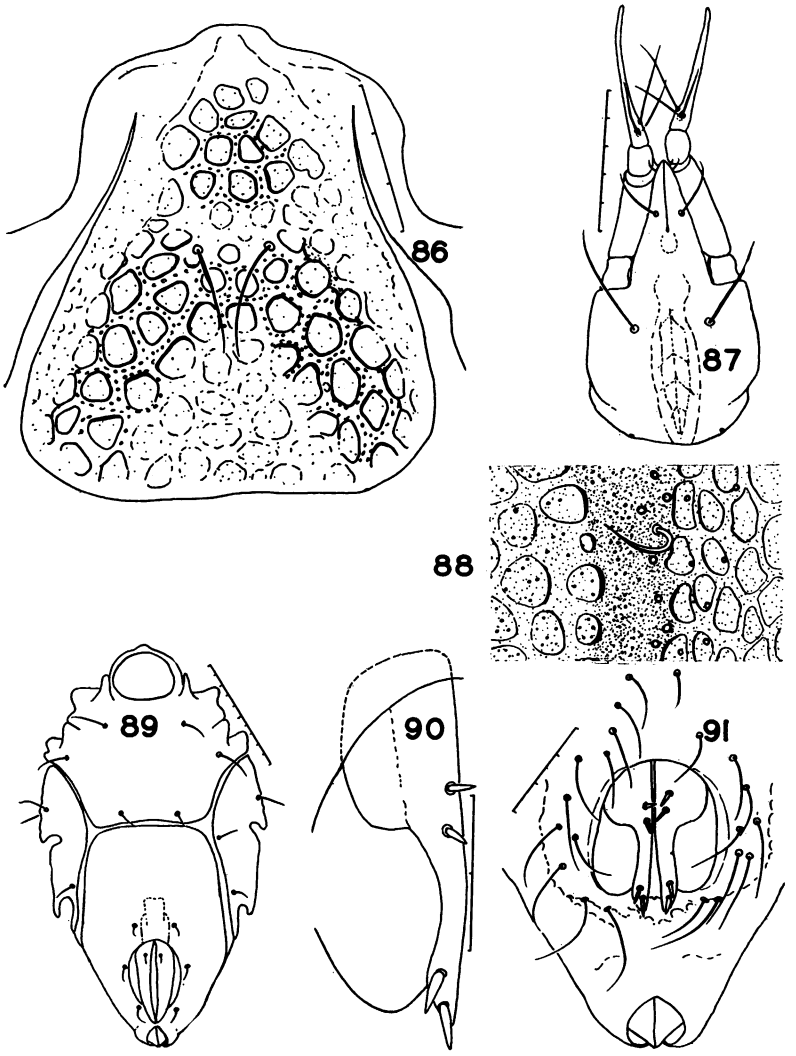
FIGS. 64–69. *Copidognathus propinquus*, new species. 64. Female, AD. 65. Female, capitulum. 66. Female, venter. 67. Female, costa of PD. 68. Male, OC, dissected. 69. Female, paneling of AE.



FIGS. 70–77. *Copidognathus propinquus*, new species. 70. Male, genital sclerite. 71. Male, leg III, medial view. 72. Male, leg I, lateral view. 73. Male, leg II, part. 74. Male, paneling of I-3. 75. Female, dorsum. 76. Female, genital opening. 77. Male, palp.



FIGS. 78–85. *Copidognathus vulcanis*, new species. 78. Male, GA. 79. Male, leg I, medial view. 80. Male, leg III. 81. Male, leg II, lateral view. 82. Male, dorsum. 83. Male, OC, dissected. 84. Female, genital opening. 85. Male, palp.



FIGS. 86–91. *Copidognathus vulcanis*, new species. 86. Male, AD. 87. Male, capitulum. 88. Male, costa of PD, at level of fourth dorsal seta. 89. Female, venter. 90. Male, genital sclerite. 91. Male, genital opening.