

No. 2.—*Millipeds Collected in Puerto Rico and the Dominican Republic*  
By Dr. P. J. Darlington in 1938<sup>1</sup>

By H. F. LOOMIS

During the summer of 1938 Dr. P. J. Darlington, of the Museum of Comparative Zoölogy, Cambridge, Massachusetts, gathered much zoological material in Puerto Rico and the Dominican Republic which included a large number of very interesting millipeds, later sent to me for identification, and now forming the basis for this paper.

The Puerto Rican collection of millipeds contained 11 species, and has been exceeded in number only by that of 12 species by Prof. W. M. Wheeler in 1906, and reported on by Silvestri<sup>2</sup>. Four species of the Darlington collection are here described as new, one being made the type of an unusual new genus of the family Stemmiulidae. With these additions, thirty species now have been recorded from Puerto Rico, but the identity of five is in doubt and cannot be settled until much more collecting and study have been done.

In the Dominican Republic 35 species were found, and these represent the first extensive collection ever to come from that country, where previously only six species had been known, one of those also being reported from the adjacent Republic of Haiti. In the Darlington collection are six previously described species, one of which was already known from the Dominican Republic, the remaining five being newly discovered there but previously known from Haiti. Twenty-eight of the species, apparently new to science, are described in the following pages, and among them are the types of eight new genera. A single remaining form was represented by inadequate material, impossible to identify specifically.

The Dominican portion of the collection is remarkable in the number of new species of *Prostemmiulus* and *Microspirobolus* it contains; and in the many new monotypic genera of the order Merocheta it has been necessary to erect to fit the animals into the current system of classification. These genera are indicative of a large undiscovered milliped fauna, and future collections in other parts of the country hardly can fail to add species to some of them. Great localization of milliped species already has been noted in Cuba<sup>3</sup>, and especially in the Republic of Haiti<sup>4</sup>, whence 108 species have been reported. The Dominican Republic, with double the area of Haiti, remains almost wholly unknown,

<sup>1</sup> Published with the aid of a special gift from Mr. George R. Agassiz.

<sup>2</sup> Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 563-578, 1908.

<sup>3</sup> Bull. Mus. Comp. Zool., Vol. 82, No. 6, pp. 427-480, 1938.

<sup>4</sup> Bull. Mus. Comp. Zool., Vol. 80, No. 1, pp. 3-191, 1936.

as far as millipeds are concerned, in spite of the present collection, and a milliped fauna comparable to that of Haiti may be expected. Another unusual feature of this collection, for which no explanation is offered, is its complete lack of species of *Cyclodesmus*. Thirteen species of this genus are known from Haiti, and its distribution certainly must extend into many parts of the Dominican Republic.

Combining the faunas of the Haitian and Dominican Republics, 141 species of millipeds now are credited to the Island of Hispaniola, but this number will be increased with each new collection from there, especially if made in hitherto unvisited regions.

Types, paratypes and all other specimens in the collection are in the Museum of Comparative Zoölogy.

### GLOMERIDESMIDAE

#### GLOMERIDESMUS PECTINATUS spec. nov.

The type, and another male and a 20-segmented female from El Yunque, Puerto Rico, May 1938.

*Diagnosis.* Intermediate in size between *G. marmoreus* Pocock and *G. trinidadensis* Loomis but readily distinguished from the former by the more rectangular shape of the pleurae which have a comb-like border of fine setae along the posterior margin in contrast to the simple margin found in the latter species.

*Description.* Length from 8 to 9.5 mm., width to 2 mm.

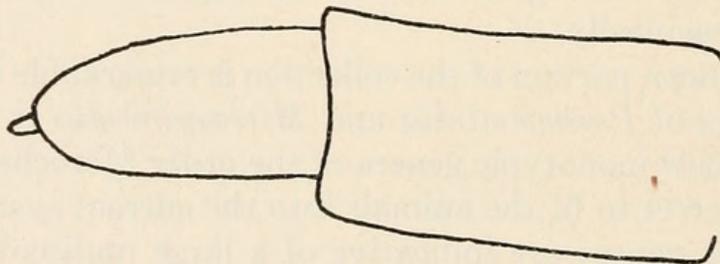


Fig. 1. *Glomeridesmus pectinatus*. Last two joints of last leg of male.

Color of head and antennae dark; first segment dark with a median W-shaped figure of white with the free ends of the figure forward; laterad of this figure, in the outer angle, is a small white spot; ensuing segments dark with a large white spot in front a third of the way to the lateral margin, the spots much smaller on the caudal third of the body; segments 2 to 4 or 5 with an additional smaller white spot in front on

each side at the median line; sides of all segments white or colorless for a distance above the lateral margin; legs and ventral surfaces colorless; one specimen, less fully colored than the others, has the head, first segment, and the outer third of the other segments colorless.

Head with the entire clypeal region swollen, forming a broad transverse elevation, on the posterior limits of which many small erect setae are evident, especially near the sides of the head, a few larger setae farther forward; pit behind the antennal socket much larger than the socket and much more nearly circular than in *G. marmoreus* as shown by Pocock's illustration.

First segment much exceeding the width of the head, in the proportion of five to four.

Caudal segments with each posterior corner produced into a small acute tooth.

Pleurae rectangular, the exposed portion broader than long, surface smooth, the posterior margin fringed with a comb of fine setae except near the outer angle.

Coxal joints of the legs broader and less angular than in *G. marmoreus*; the posterior margin simple, neither toothed nor setose.

Last leg of male with the two outer joints as shown in figure 1, the last joint apparently with a tiny peg-like claw.

Chamberlin reported<sup>1</sup>, without mention of size, color, or structural characters, a single specimen of *Glomeridesmus* from El Yunque, which he referred to *G. concolor*, described from Haiti as being from 4 to 6.5 mm. long. It now appears more probable that this specimen should be placed under *G. pectinatus* rather than under the Haitian species.

## SIPHONOPHORIDAE

### SIPHONOPHORA PLATOPS spec. nov.

Two males (one the type) and two females from rain forest near Valle Nuevo, 6,000 feet elevation, Cordillera Central, Dominican Republic, August 1938.

*Diagnosis.* A more robust species than any previously known from the island, its proportions being quite similar to *S. robusta* Chamberlin of Jamaica from which it differs in the much shorter antennae.

*Description.* Body stout, the dorsum strongly convex, densely velvety pubescent; color light yellow in alcohol but probably white in

<sup>1</sup> Proc. U. S. Nat. Mus., vol. 61, art. 10, p. 1, 1922.

life; segments 44 and 45 for the males, 55 and 61 for the females; largest male 11 mm. long and 1 mm. wide, largest female 20 mm. long and 1.5 mm. wide.

Head rather flattened from the base of the slightly decurved beak to the moderately swollen vertex and with the pubescence longer but not as abundant as that on the segments or on joints 5 and 6 of the antennae. Head and antennae shown in figure 2, *a*, the antennal

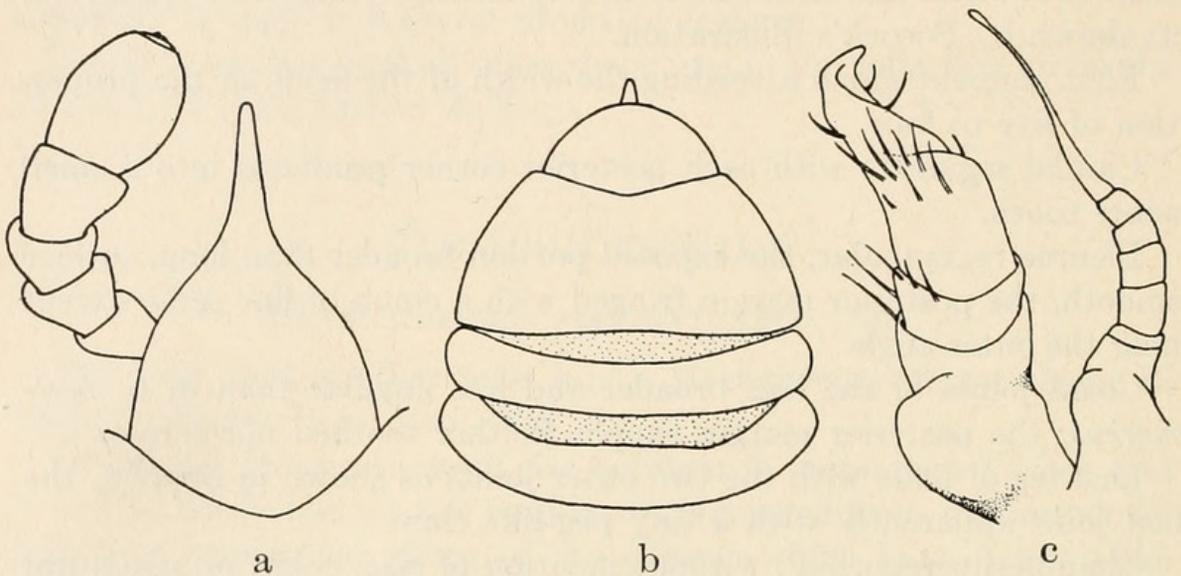


Fig. 2. *Siphonophora platops*. *a*, Head and antenna, vertical view; *b*, Segments 1 to 3 in vertical view, the head deflexed; *c*, Gonopods, outer lateral view.

sockets far around on the ventro-lateral surface, the first joint and basal portion of the second one not visible from above; antennae strongly clavate, the sixth joint longest and broadest, the seventh joint small and exceedingly short, scarcely projecting beyond the sixth joint and only half as wide.

First segment with sides sharply diverging from in front, over twice as wide behind as the head and almost as wide as the greatest diameter of the body (Fig. 2, *b*).

Gonopods shown in figure 2, *c*, the apex of the stout anterior pair bent sharply inward and backward.

Legs in advance of the gonopods almost similar in size, the first pair slightly shorter than the eighth pair.

## STEMMIULIDAE

## PROSTEMMIULUS QUINTARIUS spec. nov.

The male type and four females from the Maricao Forest, about 2,500 feet elevation, western Puerto Rico, June 2 and 3, 1938.

*Diagnosis.* Insofar as is known this is the only species having pleural lobes on the fifth segment of the male. The gonopods associate the species with the much smaller *P. wheeleri* Silvestri, from the small island of Culebra, 20 miles east of Puerto Rico.

*Description.* Body strongly compressed laterally; moderately subulate, the last 15 segments narrowing gradually; number of segments

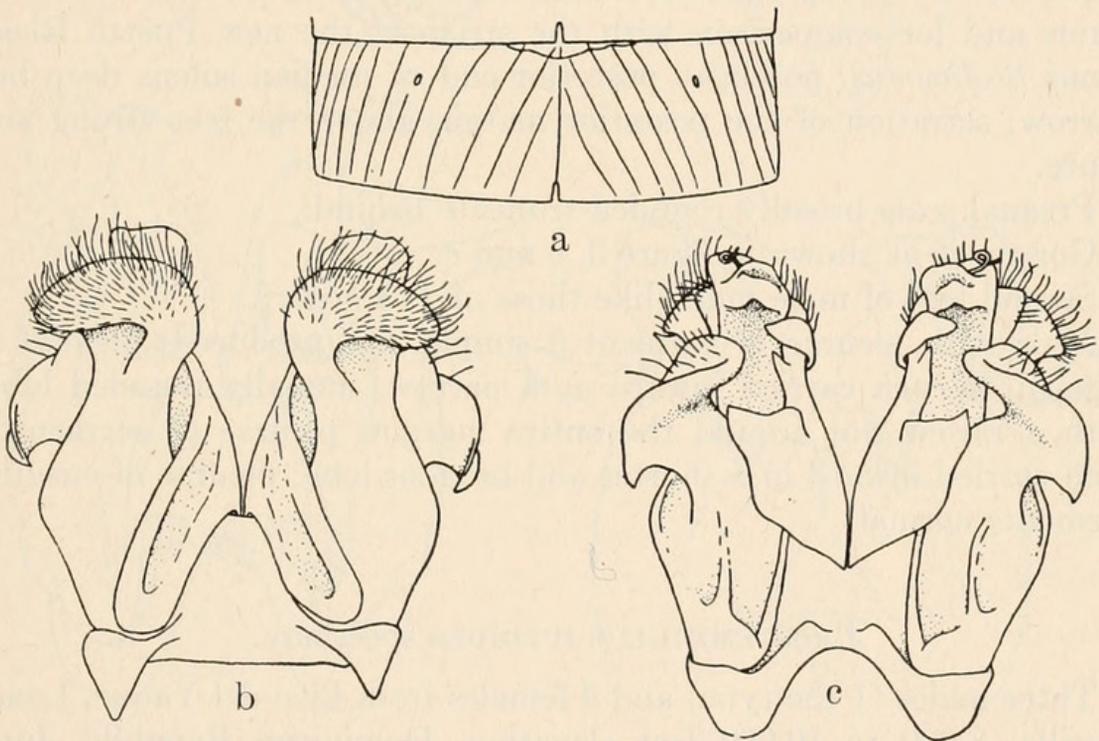


Fig. 3. *Prostemmiulus quintarius*. a, Segment from middle of body, dorsal view; b, Gonopods, anterior view; c, Gonopods, posterior view.

46 to 49; length 27 to 31 mm; males obviously more slender than females.

Color in alcohol dark slate gray, an interrupted light median line on the dorsum consisting of a very narrow line on the prozonite of each segment, part of which shows through the transparent posterior portion of the overlapping metazonite; a small light spot or mottled area at each pore with another half way between it and the base of the legs; antennae with joints 1, 6 and 7 light in color.

Head with sulcus of vertex very faint or entirely lacking; antennae long and slender, the joints of about equal width; joint 2 longest, joint 3 next in length with joints 4 and 5 slightly shorter, subequal, joint 6 two-thirds as long as joint 5; ocelli of moderate size, the posterior one half as wide as the antennal socket, the anterior one from half to nearly as large as the other; mandibulary stipe pointed in front, the upper and lower margin with a raised rim, stipe of female wider than that of male.

First segment with two or sometimes three primary striae, below which, on the subventral surface, shorter secondary striae are present.

On ensuing segments the oblique striae are sharply marked, first reaching the broad, impressed median sulcus on segment 9 or 10, the striae on a mid-body segment are shown in figure 3, *a*, as typical of the genus and for comparison with the striae of the new Puerto Rican genus *Scoliogmus*; notch at posterior end of median sulcus deep but narrow; serration of the posterior margin above the feet strong and acute.

Preanal scale broadly rounded-truncate behind.

Gonopods as shown in figure 3, *b* and *c*.

Second legs of male much like those of *P. wheeleri*.

Male with pleurae of segment 3 simple, not produced; pleurae of segment 4 each carried inward as a narrow, mesially rounded lobe, with a raised rim around the entire margin; pleurae of segment 5 each carried inward in a shorter and broader lobe; pleurae of ensuing segments normal.

#### PROSTEMMIULUS IULOIDES spec. nov.

Three males (1 the type) and 9 females from Pico del Yaque, Loma Rucilla, 8,000 to 10,000 feet elevation, Dominican Republic, June 1938. Additional specimens collected the same month from between 5,000 and 8,000 feet elevation from Loma Rucilla and mountains north, Cordillera Central, Dominican Republic.

*Diagnosis.* Aside from the gonopods, which are of the greatest importance in differentiating the species of this genus, this species shares with only *P. scaurus* and the much smaller *P. gracilipes* the peculiar character of having the side of the first segment of the male, below the lateral stria, continuous in contour with the surface above the stria, not at all bent under as is usual in the female and in both sexes of other species. From *P. scaurus* it differs in the caudally bent first legs of the male and the unmodified third legs.

*Description.* Body long and slender, much like *Paraiulus*, gradually narrowing from behind the middle of the body; the first segment of the males enlarged, wider posteriorly than remainder of body; number of segments 48 to 49, length 25 to 26 mm.

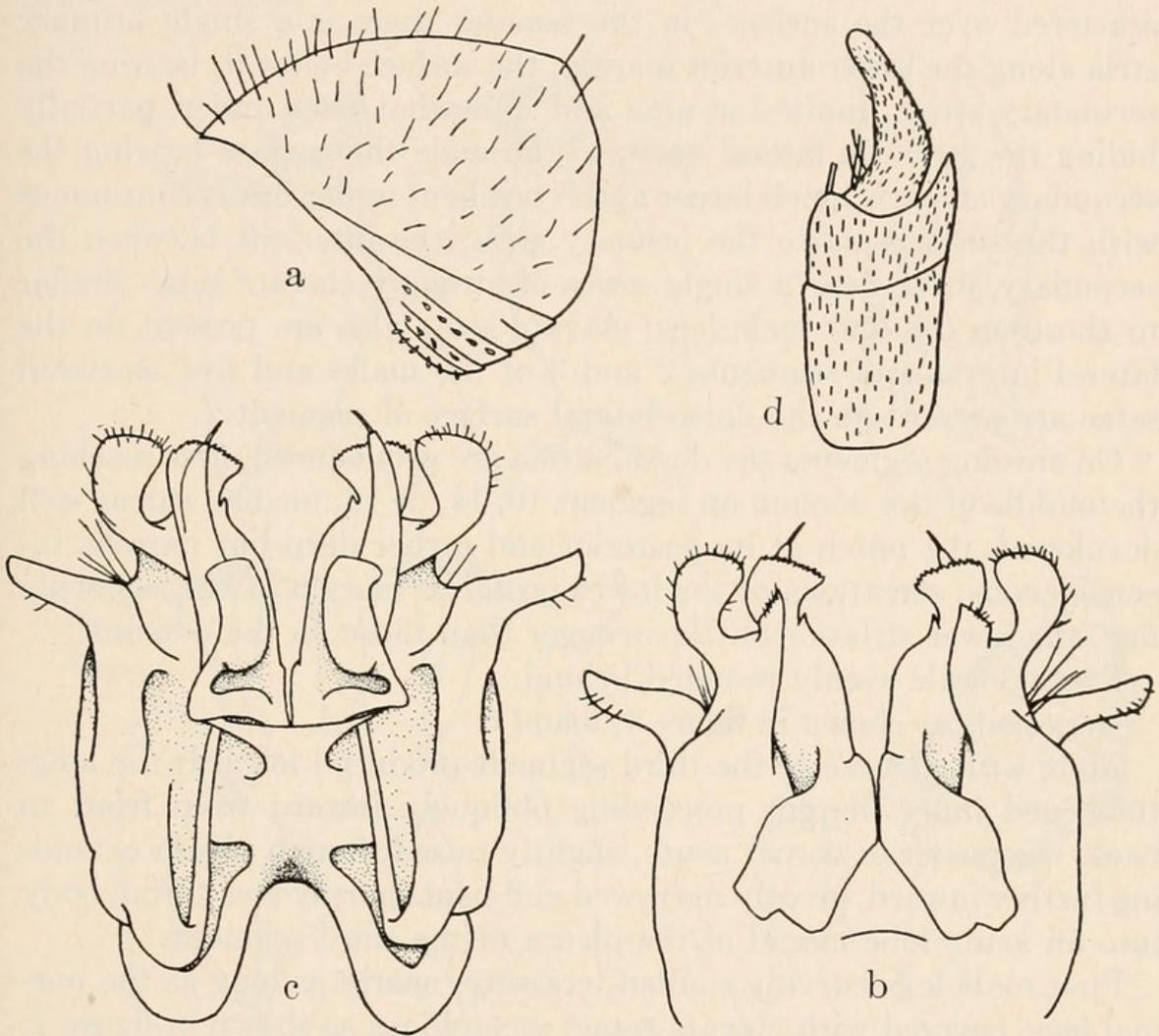


Fig. 4. *Prostemmiulus iuloides*. a, Segment 1, lateral view from slightly in front; b, Gonopods, anterior view; c, Gonopods, posterior view; d, Second leg of male, anterior view.

Color in alcohol rather dark brown except the first three segments, which are slightly lighter, especially in the males, and the light brown median line; the usual light spots on the side of each segment are faintly indicated.

Head with small eyes, the anterior ocellus about half as large as the posterior which is less than half as broad as the antennal socket; antennae with joint 2 longest; joints 3, 4, and 5 subequal; joint 6 two-thirds as long as joint 5; furrow of the vertex short but well im-

pressed; mandibulary stipe of male rounded-truncate in front, ventral fourth depressed above the margining rim, the remainder of the surface raised in a sharply angular longitudinal swelling; stipe of female wider but less sharply swollen and more pointed in front.

First segment as shown in figure 4, *a*, with numerous fine setae scattered over the surface; in the females there is a single primary stria along the lower anterior margin, the surface below it, bearing the secondary striae, limited in area and somewhat bent under, partially hiding the striae in lateral view; in the male the surface bearing the secondary striae is much larger and is not bent under but is continuous with the surface above the primary stria; the intervals between the secondary striae bear a single series of strongly clavate setae similar to those on the first male legs; clavate setae also are present on the lateral intervals of segments 2 and 3 of the males and five scattered setae are present on the dorso-lateral surface of segment 2.

On ensuing segments the dorsal striae are pronounced, first reaching the middle of the dorsum on segment 10, 11, or 12; median sulcus well developed, the notch at its posterior end rather deep but narrow, inconspicuous; serrations of the lower posterior margin of the segments fine, the lower striations little stronger than those on the dorsum.

Preanal scale evenly rounded behind.

Gonopods as shown in figure 4, *b* and *c*.

Male with pleurae of the third segment produced inward; the long, thickened inner margin proceeding obliquely inward from front to back, the posterior corner acute, slightly raised; fourth pleura extending further inward, greatly narrowed and bent sharply away from body into an acute lobe mesad of the pleura of the third segment.

First male legs curving caudad, crassate, nearly as long as the normal legs, covered with clavate setae; second legs as shown in figure 4, *d*; third and fourth legs decreasingly crassate but increasing in length toward that of the ensuing legs; setae of the third legs clavate, those of the fourth legs normal.

#### PROSTEMMIULUS SCAURUS spec. nov.

One male (type) and two females, the largest of which lacks the head and at least the first four segments, collected at Valle Nuevo, southeast of Constanza, elevation about 7,000 feet, Cordillera Central, Dominican Republic, August 1938.

*Diagnosis.* Several characters, including the form of the first segment of the male and the presence on it and several ensuing segments

of clavate setae, might be thought to associate this species with *P. iuloides* but the gonopods belie close relationship; greatly enlarged third male legs are not found in other members of the island fauna except the much smaller Haitian *P. clavipes* Loomis which also shows other differences.

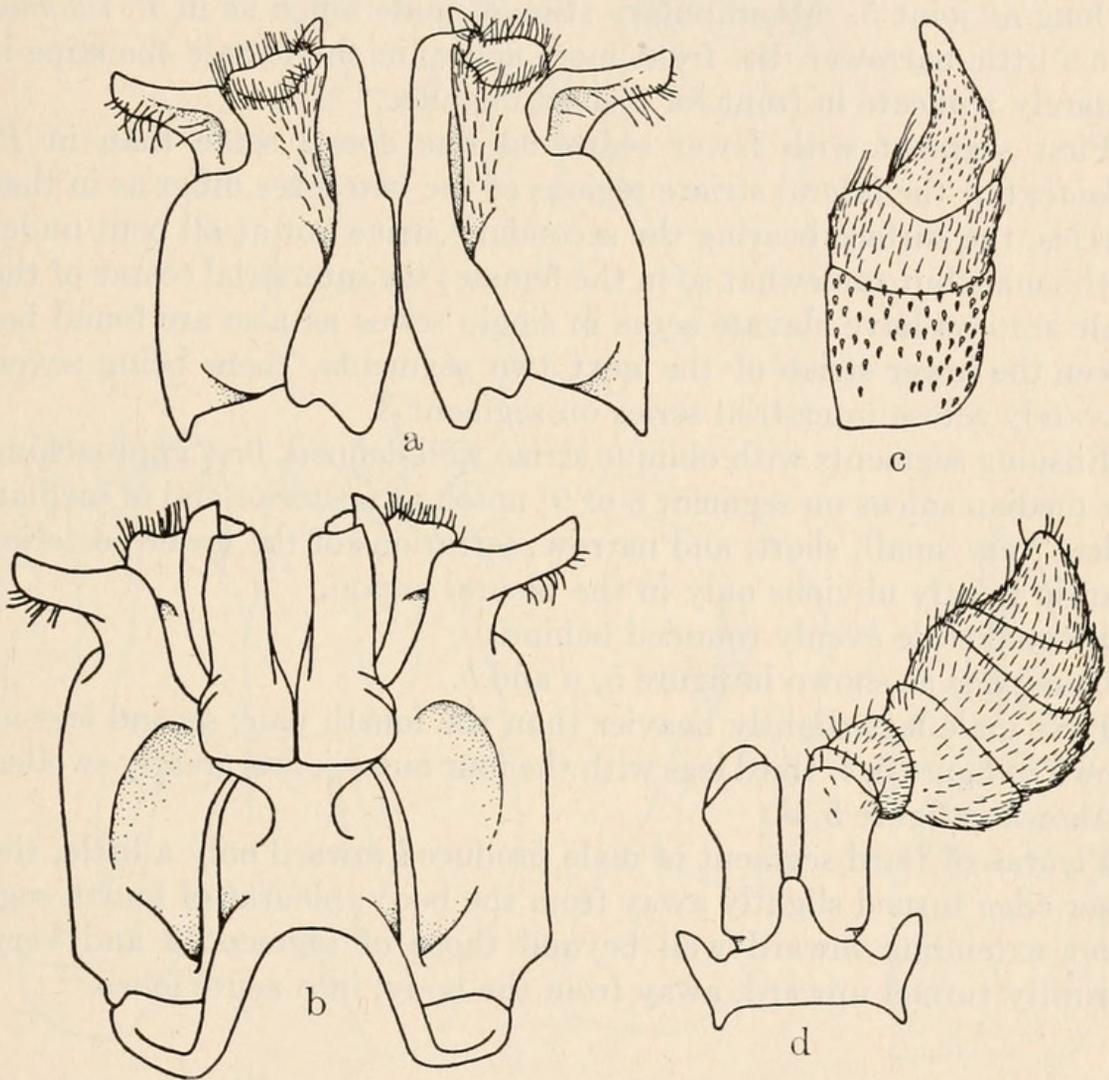


Fig. 5. *Prostemmiulus scaurus*. a, Gonopods, anterior view; b, Gonopods, posterior view; c, Second leg of male, anterior view; d, Third leg and sternal plate of male.

*Description.* Body relatively slender and parallel-sided as in *P. iuloides*, resembling a *Paraiulus*; male 25 mm. long, the broken female at least 30 mm. long in life; number of segments 46 to 47.

Color brown in alcohol, a continuous broad light median line the length of the body, the line slightly broader on the anterior portion of each segment, its sides less definite than with most species; at each

pore is a medium sized white spot below which the color becomes lighter brown, finely mottled with white, the region near the legs white.

Head with the eyes unusually small, the posterior ocellus less than half as wide as the antennal socket, the anterior ocellus scarcely half as wide as the posterior one; antennae of usual proportions, with joint 2 longest, the next three joints subequal in length, joint 6 two-thirds as long as joint 5. Mandibulary stipe of male much as in *P. iuloides* but a little narrower, the front more acute; in the female the stipe is squarely truncate in front for a short distance.

First segment with fewer scattered fine dorsal setae than in *P. iuloides* but the lateral striate regions of the two sexes differ as in that species, the surface bearing the secondary striae not at all bent under in the male but somewhat so in the female; the interstitial costae of the male *scaurus* have clavate setae in single series as also are found between the lower striae of the next two segments, there being seven clavately setose interstitial series on segment 3.

Ensuing segments with oblique striae well defined, first approaching the median sulcus on segment 8 or 9; notch at posterior end of median sulcus very small, short, and narrow; serrations of the lower posterior margin faintly obvious only in the pleural region.

Preanal scale evenly rounded behind.

Gonopods as shown in figure 5, *a* and *b*.

First male legs slightly heavier than the fourth pair; second legs as shown in figure 5, *c*; third legs with the four outer joints greatly swollen as shown in figure 5, *d*.

Pleurae of third segment of male produced inward only a little, the inner edge turned slightly away from the body; pleurae of fourth segment extending inward well beyond those of segment 3 and very abruptly turned upward, away from the body, into acute lobes.

#### PROSTEMMIULUS GRACILIPES spec. nov.

One male (type) and six females from rain forest near Valle Nuevo, about 6,000 feet elevation, Cordillera Central, Dominican Republic, August 1938.

*Diagnosis.* The small size of the body with its interrupted light median line, coupled with the form of the pleurae of the third and fourth segments of the male, outwardly distinguish this species, although the gonopods are more definitely characteristic.

*Description.* Body somewhat subulate, gradually tapering backward from the middle; length 11 to 15 mm; number of segments 38 to

45. Color much as in *P. sulcatus*, the median spot on the prozonites is broader and the lower spot on the sides is as large and distinct as that at each pore.

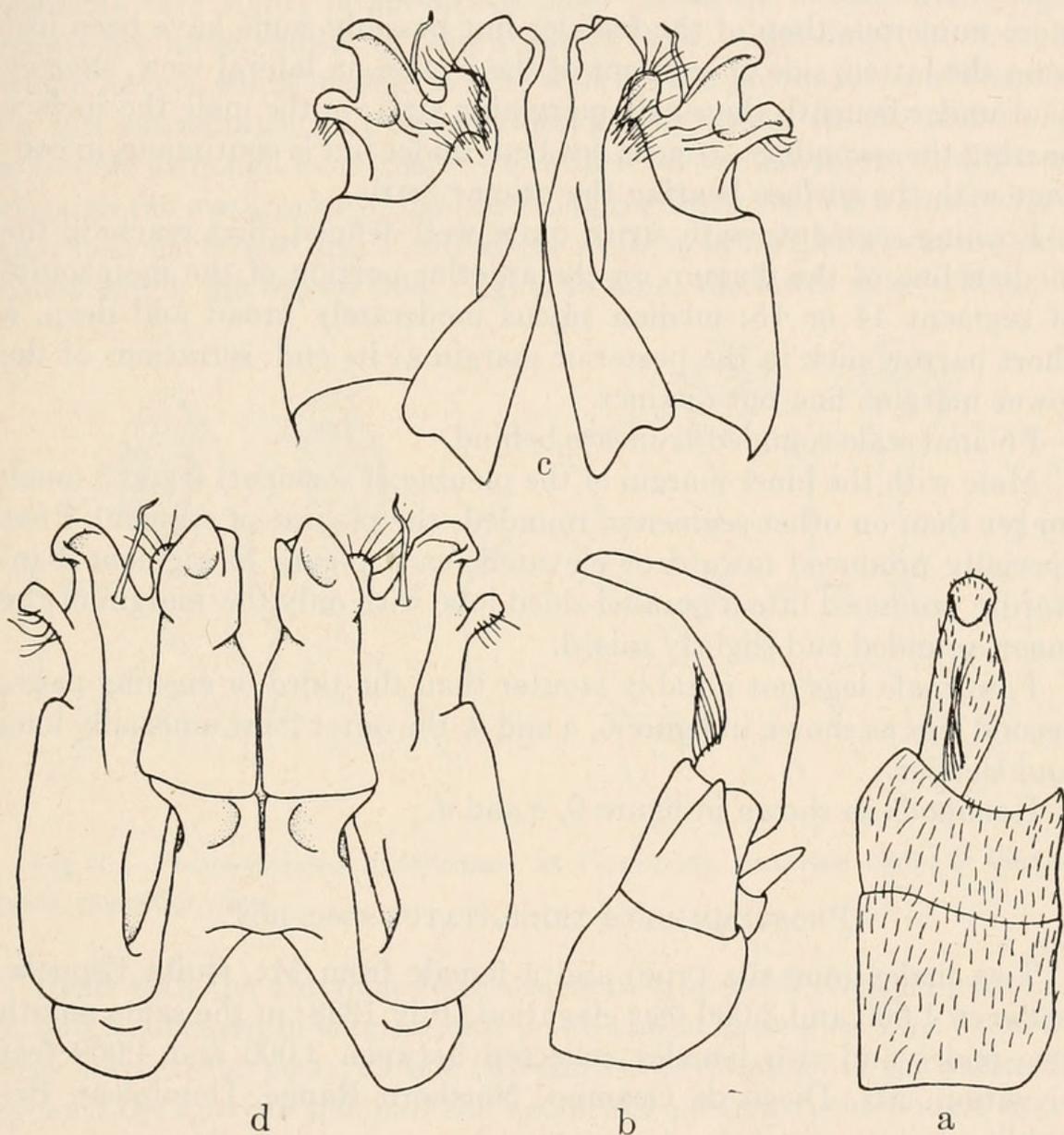


Fig. 6. *Prostemmiulus gracilipes*. a, Second leg of male, anterior view; b, Second leg of male, outer, lateral view; c, Gonopods, anterior view; d, Gonopods posterior view.

Head with the antennae rather short and stout; the second joint not greatly longer than the ensuing three subequal joints; the sixth joint fully two-thirds as long as joint 5; anterior ocellus minute, distinctly less than half the diameter of the posterior ocellus which itself

is unusually small, not equalling half the width of the antennal socket; mandibulary stipe of the male narrower and less inflated than that of the female, both acute in front.

First segment with setae scattered over the surface, those of the male more numerous than of the females but possibly some have been lost from the latter; side of segment of the female, in lateral view, sharply bent under beneath the single margining stria; in the male the surface bearing the secondary striae is not bent under but is continuous in contour with the surface bearing the primary stria.

Ensuing segments with striae quite well defined, first reaching the median line of the dorsum on the anterior portion of the metazonite of segment 14 or 15; median sulcus moderately broad and deep, a short narrow nick in the posterior margin at its end; serrations of the lower margins fine but distinct.

Preanal scale rounded-truncate behind.

Male with the inner margin of the pleurae of segments 2 and 3 much longer than on other segments, rounded; the pleurae of segment 3 not specially produced inward or elevated; each pleura of segment 4 inwardly produced into a parallel-sided lobe with only the margin of the inner, rounded end slightly raised.

First male legs not notably stouter than the third or ensuing pairs; second legs as shown in figure 6, *a* and *b*, the outer joint unusually long and slender.

Gonopods as shown in figure 6, *c* and *d*.

#### PROSTEMMIULUS TRIDIGITATUS spec. nov.

Two males (one the type) and a female from Mt. Quita Espuela, between 1,000 and 3,000 feet elevation, July 1938; in the same month two males and two females collected between 3,000 and 4,000 feet elevation, Mt. Diego de Ocampo, Northern Range, Dominican Republic.

*Diagnosis.* The gonopods, with the three finger-like processes at the posterior apex of each inner armature, are the most distinctive character of this species but an outward peculiarity is the faint impression of the dorsal striae and generally their failure to approach close to the median sulcus of the segments.

*Description.* Body strongly subulate, narrowing sharply from the middle to the very narrow last segment; the larger specimens all about 25 mm. long, the females 2.2 mm. wide and 2.5 mm. high, males not so stout or so noticeably compressed; segments 43 to 47.

Color in alcohol brown with light markings; specimens from type locality with anterior two-thirds of first segment dark, the posterior third and segments 2 and 3 and the anterior portion of the fourth segment very light; in specimens from the other locality these segments are more similar in coloration to those succeeding, the first of which have a white median fascia, wide on the prozonites and narrow on the metazonites, but this becoming very broad on the mid-body segments although even there it is widest on the prozonite and shows through the metazonite of the preceding segment; there is a small white spot near each pore and a still larger white spot farther down the side below which the brown color begins to fade, the lower sides white.

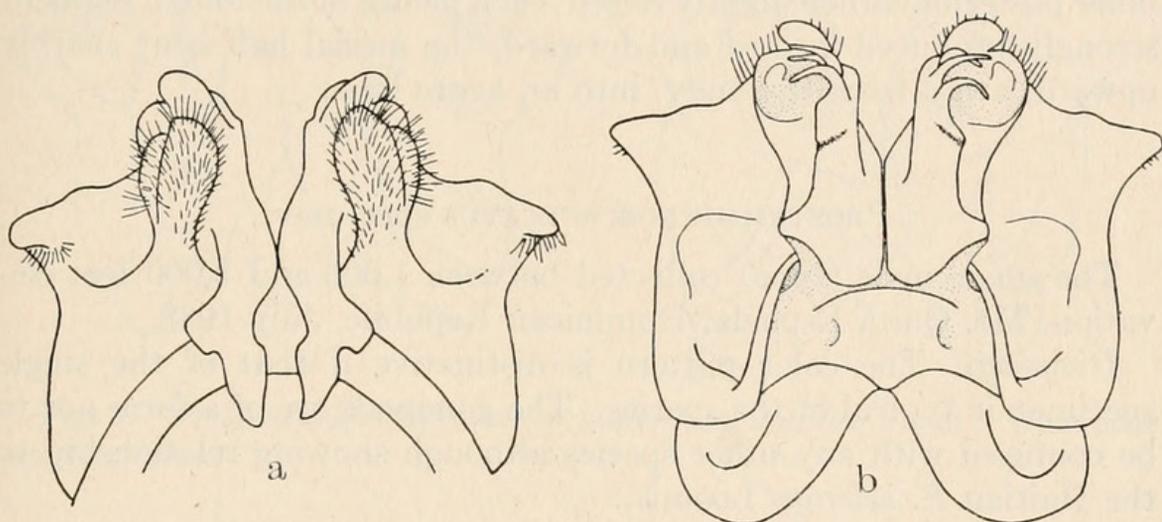


Fig. 7. *Prostemmiulus tridigitatus*. a, Gonopods, anterior view; b, Gonopods, posterior view.

Head with the antennae long and slender; joint 2 longest; joints 3, 4, and 5 subequal in length; joint 6 two-thirds as long as joint 5; ocelli very convex; the posterior one two-thirds the diameter of the antennal socket; the anterior one half the size of the posterior; the female from the type locality has, on one side of the head, a third ocellus the size of the anterior one and mesad of the posterior ocellus; mandibular stipe of the male rounded-acute in front; a raised rim on all sides, with the inner surface evenly inflated; stipe of female larger, relatively broader and slightly more convex.

First segment with a few scattered hairs on the dorsum; the side of the segment, below the single primary stria, bent under in both sexes, hiding the subventral or secondary stria from lateral view.

On ensuing segments the oblique striae are very fine and weakly impressed and do not extend above the pores until after segment 10 or

even further back, and thereafter four striae, at most, are seen above the pore on either side, the innermost seldom approaching close to the median sulcus even toward the anterior limit of the metazonites; dorsal surface with coarse, longitudinal, slightly undulated aciculations; lower posterior margin of segments with coarse serrations quite remarkable in view of the weak striae.

Preanal scale rounded truncate behind.

Gonopods as shown in figure 7, *a* and *b*.

Second male legs much like those of *P. scaurus*, the outer joint turned forward sharply; third legs normal.

Pleurae of third segment of male scarcely at all produced mesad, the inner posterior corner slightly raised; each pleura of the fourth segment strongly produced inward and forward, the mesial half bent sharply upward, away from the body, into an acute lobe.

#### PROSTEMMIULUS SULCATUS spec. nov.

The single male (type) collected between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

*Diagnosis.* The color pattern is distinctive if that of the single specimen is typical of the species. The gonopods are of a form not to be confused with any other species although showing relationship to the Haitian *P. heterops* Loomis.

*Description.* Body subulate, tapering toward the back from in front of the middle of the body; length 20 mm; number of segments 42.

Color generally dark, the usual light median fascia reduced to an elongate spot on the prozonite of each segment but showing through the translucent integument of the metazonite of the preceding segment, a larger white spot at each pore with a smaller, less definite spot between it and the base of the legs.

Head with the eyes small, the anterior ocellus half as large as the posterior one which is much smaller than the antennal socket; antennae with joint 2 longest; joints 3, 4, and 5 subequal; joint 6 over two-thirds as long as joint 5, mandibulary stipe surrounded by a raised rim; the median portion strongly inflated; anterior margin very obliquely truncated, the truncation almost continuous with the lower margin.

First segment with setae sparsely scattered over the surface; a single stria along the anterior margin each side with shorter, less pronounced striae on the sharply bent under, subventral surface.

Oblique striae of ensuing segments well defined, first reaching the

middle of the dorsum at the anterior part of segment 11 or 12; median sulcus broadly and deeply impressed on the posterior part of each metazonite, the notch in the margin at its end shallow and very conspicuous; serrations along the lower posterior margin of the segments weak.

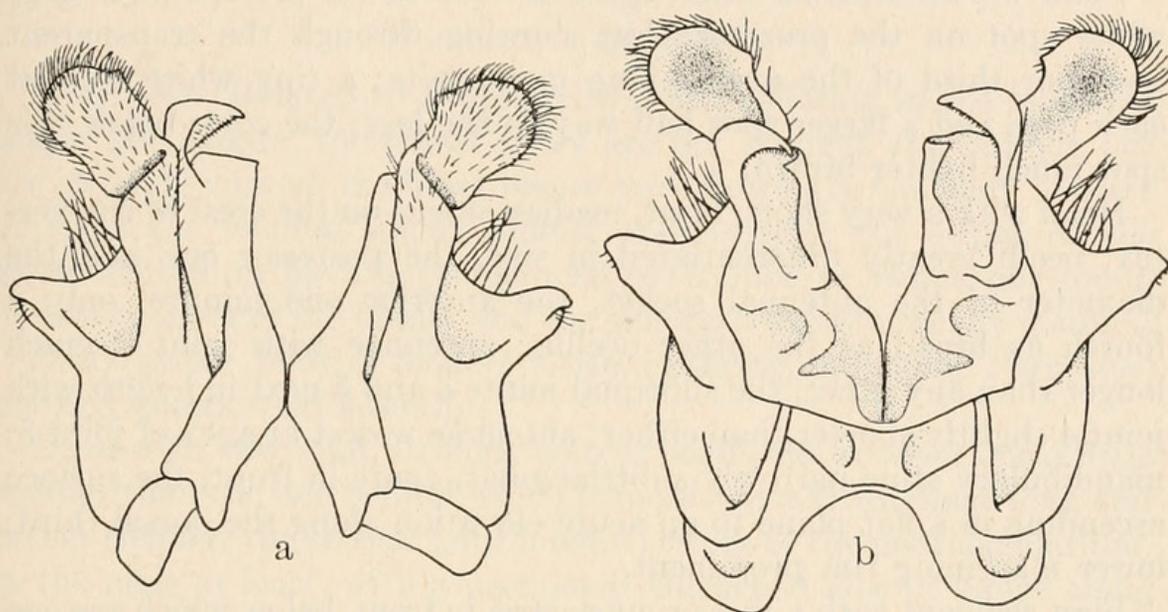


Fig. 8. *Prostemmiulus sulcatus*. a, Gonopods, anterior view; b, Gonopods, posterior view.

Preanal scale with a quite definite truncation at apex, not evenly rounded.

Gonopods as shown in figure 8, a and b.

First male legs very little stouter than the normal third legs.

Third pleura not produced mesially but inwardly elevated, especially at the posterior corner; fourth pleura produced inward, ending in a broadly rounded, slightly upturned, apex.

#### PROSTEMMIULUS SETOSUS spec. nov.

A single female from Valle Nuevo, southeast of Constanza, elevation about 7,000 feet, Cordillera Central, Dominican Republic, August 1938.

*Diagnosis.* In this genus, founding of species on female types cannot be justified unless a unique distinguishing character or a peculiar combination of several characters is present. The scattered setae on the dorsum of the above specimen is a character which fully warrants erection of a new species as it is found in no other known member of

the family, the usual arrangements of setae being a single series along the posterior margin of each segment.

*Description.* Body mostly parallel-sided, the posterior third narrowing slowly to the moderately broad last segment; not conspicuously compressed laterally; length 17 mm; number of segments 46.

Color brown with an interrupted median fascia present as a large white spot on the prozonite but showing through the transparent posterior third of the overlapping metazonite; a tiny white spot at each pore and a larger spot half way to the legs; the color below this spot much lighter brown.

Head with a very short, faint, median sulcus on the crest of the vertex; ocelli greatly differentiated in size, the posterior one half the diameter of the antennal socket, the anterior one minute, only a fourth as broad as the other ocellus; antennae with joint 2 much longer than any other, the subequal joints 3 and 5 next in length with joint 4 slightly shorter than either; antennae widest at apex of joint 5; mandibular stipe narrowly subtriangular, acute in front, the surface ascending in a flat plane to an acute elevation along the dorsal third; lower margining rim prominent.

First segment with a fine primary stria in front, below which are one or two very fine, short, secondary striae; region above the lower part of the primary stria subrugose with fine longitudinal wrinkles; surface scattered with fine erect setae which are more numerous along the front and back margin than on the central portion.

Ensuing segments with a posterior marginal row of 16 to 22 fine setae and additional setae sparsely scattered over the remainder of the dorsal surface of the metazonites; oblique striae well defined, not reaching the moderately impressed median sulcus until the middle of the body or beyond; posterior half of metazonites coarsely marked with numerous deep longitudinal aciculations; median notch of posterior margin minute, very short and narrow, serrations of margin very small but acute, confined to the area beneath the legs.

Preanal scale almost semicircularly rounded behind.

#### PROSTEMMIULUS SP.

Eight females, ranging in length from 18 mm. to 45 mm. from El Yunque, Puerto Rico, May 1938.

It is to be regretted that males were missing from this collection, for without them identification is not possible. The specimens appear to belong to a single species, in spite of the great variation in size, and

were only those of intermediate size present they would be considered as *P. compressus* (Karsch). However, since the largest specimens far exceed any other West Indian *Prostemmiulus* in length they cannot be assumed to be *P. compressus* until more is known about that species.

#### SCOLIOGMUS genus nov.

*Diagnosis.* Related to *Prostemmiulus* but differing in the following major particulars: the dorsal striae are not straight and oblique but are strongly curved, the inner one or two showing a tendency to meet or cross the median sulcus almost transversely; the stipes of the gnathochilarium have a pronounced outer lobe or flange not found in other genera of the family and the gonopods are generically distinct.

*Description.* Body of moderate size, cylindric, much like *Paraiulus*, scarcely compressed laterally.

Head with two large, strongly convex ocelli, the anterior one a little smaller than the one behind which is more convex; antennae long and rather slender, the second joint longest; stipes of the gnathochilarium, in the male at least, with a prominent thickened lobe or flange along the outer side.

First segment much as in *Prostemmiulus*.

Ensuing segments with pronounced striae, those on the dorsum strongly sinuously curved except the uppermost one or two which are more nearly curved in a simple segment of a circle and tend to meet or cross the lightly impressed median sulcus at approximately a right angle; pleural sutures closed as in *Prostemmiulus*.

Gonopods terminating in a long, curved arm on either side, which, in repose, remains outside the body.

Anterior legs of the male lacking the strongly clavate setae characteristic of these legs in *Prostemmiulus*.

Type. *S. teres* spec. nov.

#### SCOLIOGMUS TERES spec. nov.

A single male from the Maricao Forest, elevation about 2,500 feet, western Puerto Rico, June 2 and 3, 1938.

*Description.* Body cylindric, very indefinitely compressed laterally, except on the caudal segments, the proportions much like *Paraiulus*, the posterior end less tapering than usual in *Prostemmiulus*; length 33 mm.; number of segments 49.

Color in alcohol dark brown with yellow and white markings; median

line yellow, continuous from segment 2 to the apex of the last segment; on all but a few of the first and last segments the line is much broader at the anterior margin of each metazonite; prozonites white, in part showing through the transparent posterior portion of the metazonites; in front of each pore and slightly above it is a tiny white spot; pore in a large area maculate with light spots; below the pore the color lightens, becoming almost white ventrally.

Head with the median furrow long, faintly impressed; antennae long and moderately slender; joint 2 longest and as slender as joint 3; joints 3, 4 and 5 decreasing slightly in length; joint 5 over twice as broad at apex as at base but still not as broad as joint 6 which is over two-thirds as long; ocelli large and prominent, the posterior one nearly as broad as the antennal socket and almost hemispherically convex; anterior ocellus considerably more than half as broad as the posterior but not quite as convex; mandibular stipe broad, rounded in front, strongly inflated, surrounded by a raised rim thickest along the lower margin; gnathochilarium peculiar in having the stipes expanded on the outer side by the presence of a large thickened lobe or flange as shown in figure 9, *a*.

First segment (Fig. 9, *b*) not sharply turned under at the lower angle, showing two secondary striae in lateral view, with a long primary stria above them and, considerably above this, another stria proceeding from the posterior margin half way to the anterior margin.

On ensuing segments the dorsal striae first reach the median sulcus at segment 7 or 8, the striae well defined, not straight and oblique as in *Prostemmiulus* but strongly bent, undulated or merely simply curved, the innermost one or two meeting or crossing the fine, lightly impressed median sulcus at nearly a right angle (Fig. 9, *c*); intervals between the striae with fine longitudinal aciculations; median notch of the posterior margin small, broad, and shallow, inconspicuous; serrations of the lower posterior margins very fine, almost obsolete; caudal segments gradually narrowing and slightly compressed laterally, the last segment wider than in most species of *Prostemmiulus*.

Preanal scale large, broadly rounded behind.

Gonopods as shown in figure 9, *d*, *e*, and *f*, the finely striate, curved, apical arm of each gonopod protruding outside the body and resting against the lower side of segment 7.

First male legs with the two basal joints thin but very broad, much broader than long, the next joint longer and thicker than the corresponding joint of the midbody legs, the three outer joints little heavier than those of the third or ensuing legs but with a comb of fine setae

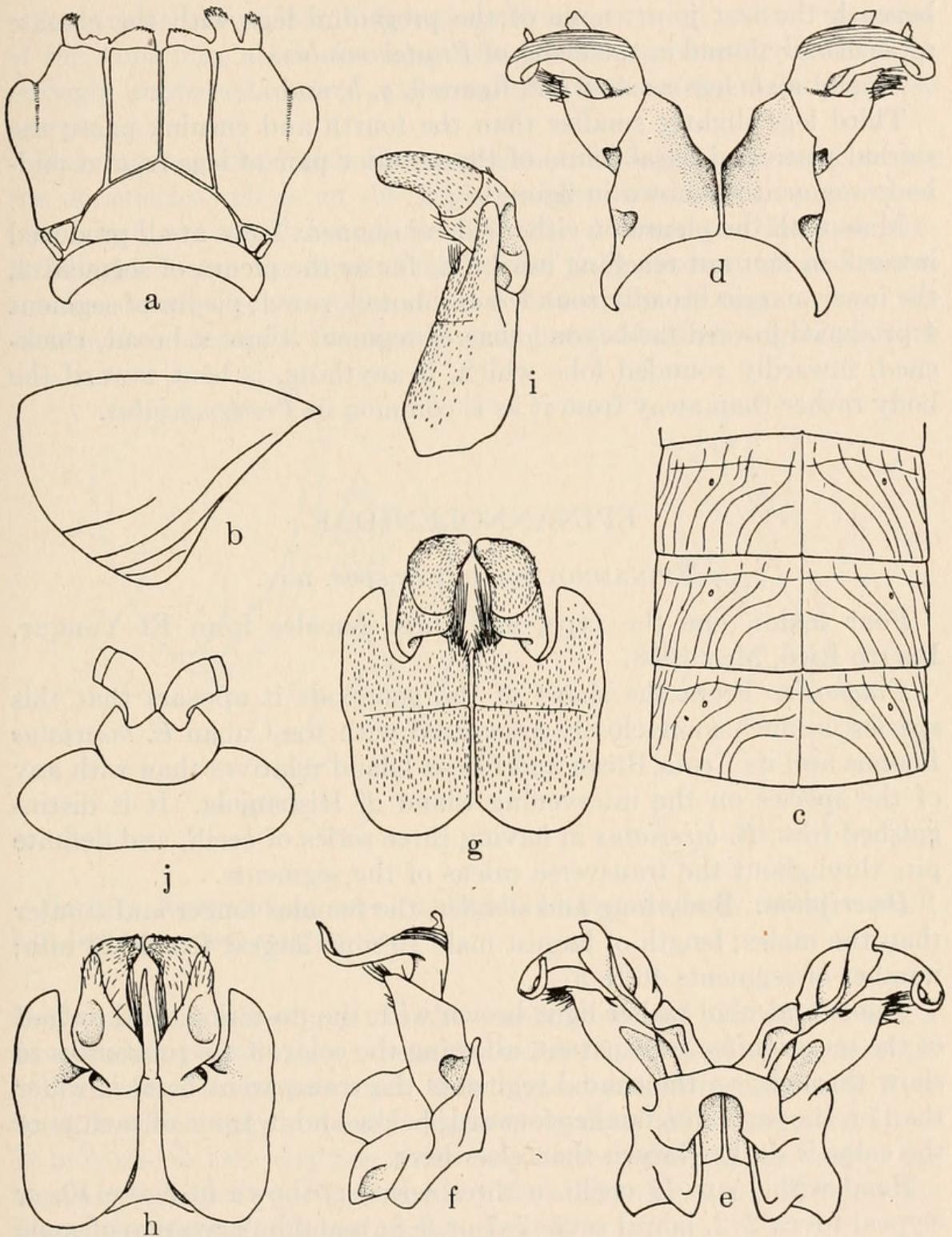


Fig. 9. *Scoliognmus teres*. a, Gnathochilarium; b, Segment 1, ventrolateral view to show the two subventral striae below the long lateral stria; c, Three segments from middle of body, dorsal view; d, Gonopods; anterior view; e, Gonopods, posterior view; f, Gonopods, anterolateral view from slightly above; g, h, & i, Second male legs, anterior, posterior, and lateral views, respectively; j, Basal joints of legs and sternal plate of anterior legs of segment 13, male.

beneath the last joint; none of the pregenital legs with the clavate setae usually found in the males of *Prostemmiulus*.

Second male legs as shown in figure 9, *g*, *h*, and *i*.

Third legs slightly smaller than the fourth and ensuing pairs; the sternal plate and basal joints of the anterior pair of legs from a mid-body segment as shown in figure 9, *j*.

Male with the pleura on either side of segment 3 not at all produced inward, in fact not reaching inward as far as the pleura of segment 2, the inner margin broadly rounded and not elevated; pleura of segment 4 produced inward far beyond that of segment 3 into a broad, thickened, inwardly rounded lobe which, if anything, is bent toward the body rather than away from it as is common in *Prostemmiulus*.

## EPINANNOLENIDAE

### EPINANNOLENE CURTA spec. nov.

Four males, one the type, and three females from El Yunque, Puerto Rico, May 1938.

*Diagnosis.* From the shape of the gonopods it appears that this species is much more closely associated with the Cuban *E. biseriatus* Loomis and its Costa Rican and Cocos Island relatives than with any of the species on the intervening island of Hispaniola. It is distinguished from *E. biseriatus* in having three series of ocelli, and definite pits throughout the transverse sulcus of the segments.

*Description.* Body long and slender, the females longer and stouter than the males; length of largest male 19 mm, largest female 23 mm; number of segments 46 to 57.

Color in alcohol rather light brown with the posterior third or half of the metazonites transparent, allowing the color of the prozonites to show through; on the caudal segments the transparent band is wider than on the segments farther forward; below and in front of each pore the color is darker brown than elsewhere.

Head with 15 to 17 ocelli in three series as shown in figure 10, *a*; clypeal fovea 2-2, labral setae 7-7 or 8-8; mandibular stipe of male narrower and a little less convex than that of the female and with a higher raised margining rim, anterior end narrowly rounded in both sexes.

First segment as shown in figure 10, *a*, with a fine stria along the front margin below the eye; behind this is a longer stria, its lower half broader and much more deeply impressed than the upper half, the

stria variously curved in different specimens or even on the two sides of the same one; above the long stria one or two shorter but usually strongly impressed, curved, striae proceed forward from the posterior margin.

Ensuing segments with the constriction strongly impressed across the dorsum as well as on the sides, its bottom occupied by a row of pits which are small but distinct on the dorsum and increase materially in size on the ventral half of the body; prozonites and metazonites equally convex, the former brilliantly shining as are the metazonites above the fine lateral striae, each of which originates from

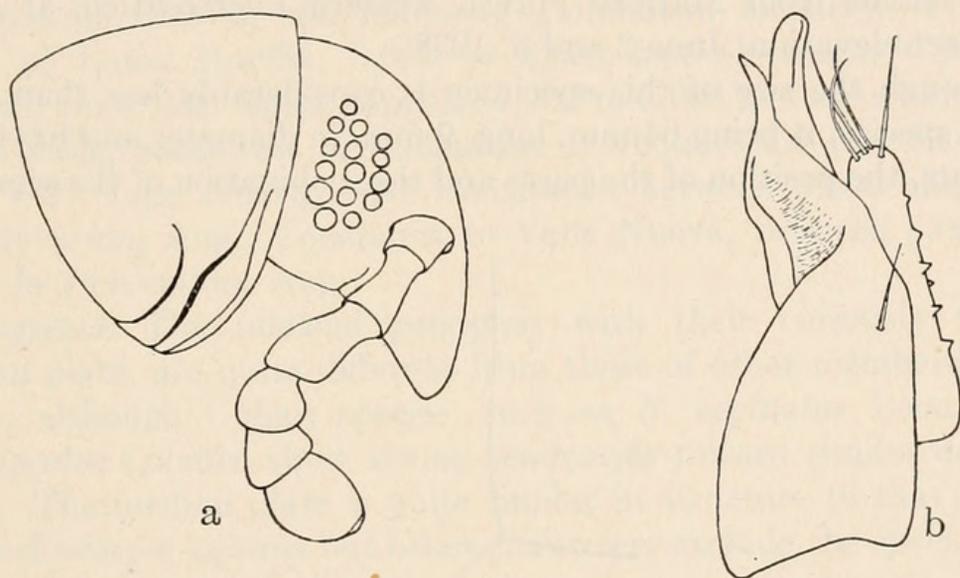


Fig. 10. *Epinannolene curta*. *a*, Head and first segment, lateral view; *b*, Left hand gonopod, anterior view.

the bottom margin of a pit in the constriction and extends back in a downwardly bowed curve; the striae extend fairly well up on the sides of segments 2 and 3 but reach their highest point on segment 4, 5, or 6, after which they suddenly decrease so that behind segment 10 or 11 only one or two very fine striae may be seen close to the base of the legs; at the highest point reached by the striae they are well below the line of the pores which begin at segment 5.

Last segment large and hood-like, the apical portion not in the least produced, the posterior margin continuing in the same direct line throughout its length.

Preanal scale with posterior margin much less rounded than the anterior margin or very faintly angled at middle; lateral processes of moderate size.

Gonopods shown in figure 10, *b*, quite closely resembling those of *E. biseriatus* but several differences are apparent.

Ventral margin of segment 7 raised into a lobe on each side much like that shown in Brolemann's figure for *E. pittieri*<sup>1</sup>, the lobes slightly narrower in relation to their height.

## SPIROBOLIDAE

### RHINOCRICUS PARCUS Karsch

*Rhinocricus parcus* Karsch, Zeits. Naturwiss., Ser. 3, Vol. 6, p. 68, 1881.

One female from Maricao Forest, western Puerto Rico, at about 2,500 feet elevation, June 2 and 3, 1938.

Although the size of this specimen is considerably less than given for the species, it being 64 mm. long, 9 mm. in diameter and having 44 segments, the position of the pores and the scobination of the segments

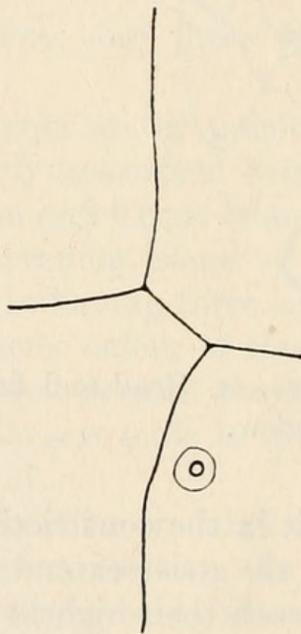


Fig. 11. *Rhinocricus parcus*. Repugnatorial pore and sutures on side of segment from middle of body.

leaves no doubts as to the correctness of identification. The repugnatorial pores all are well removed below the lateral suture and in front of the transverse one; the sutures, clearly indicated by light colored lines in the dark integument, are as indicated in the accompanying figure 11. Scobinae are present on segments 8 to 12 only and are much

<sup>1</sup> Ann. Soc. Ent. Fr., Vol. 72, p. 138, figs. 6, 7, 1903.

broader in proportion to the size of the body than in any other species with which I am familiar, the broadest measuring over 3 mm. each. On segments 7 to 11 the posterior margin, above each scobina of the succeeding segment, is deeply emarginate and the margin is much thicker than elsewhere.

Seventh joint of the antennae with numerous sense cones.

#### RHINOCRICUS HISPANIOLUS spec. nov.

The male type and five paratype males and females from Jarabacoa, Dominican Republic, August 2, 1938. Additional specimens also collected in 1938 in the following Dominican localities—Foothills north of Loma Rucilla, 5,000 to 8,000 feet elevation, Cordillera Central, June; Mt. Quita Espuela, 1,000 to 3,000 feet elevation, July; Loma Vieja, southwest of Constanza at about 6,000 feet elevation, Aug. 7-9; Valle Nueva, near Constanza, between 6,000 and 8,000 feet elevation, Aug.; Constanza to Valle Nueva, between 3,000 and 7,000 feet elevation, Aug.

*Diagnosis.* The unusual gonopods with their curiously formed median plate, are quite different from those of other members of the genus, although Cuban species, such as *R. sagittatus* Loomis and *R. clypeatus* Loomis, show strong tendencies toward similar development. The median plate is quite similar in structure to that in *Leiocricus diversipes* Loomis but other characters exclude the species from that genus.

*Description.* Body from 40 to 50 mm. long and 3.5 to 4.5 mm. in diameter, the males more slender than the females; number of segments 47 to 50; color in alcohol dark brown, almost black, with lighter mottlings on the sides, the posterior margin of each segment colorless-translucent; head and median area of first segment lighter brown.

Head with 19 to 25 flat, inconspicuous, ocelli in five series forming a rather small rounded group; median sulcus more or less impressed from the back of the vertex to the front of the clypeus; antennae short and stout, the sixth joint densely pubescent in contrast to joint 5 which has only a few hairs at the distal end; sense cones four; cardo of mandibles broad and flat, with a thick raised rim except along the back margin, the anterior margin squarely truncated, the lower anterior corner a right angle or frequently produced into a distinct tooth; gnathochilarium as shown in figure 12, *a*, the lower half of the mentum transversely striate, the lower half of the stipes with several vertical wrinkles.

First segment broadly and evenly rounded on the sides, the raised rim short, present only along the lower anterior-lateral margin.

Second segment with a distinct angular shoulder below the limits of segment 1, the ventral surface concave and coarsely striate.

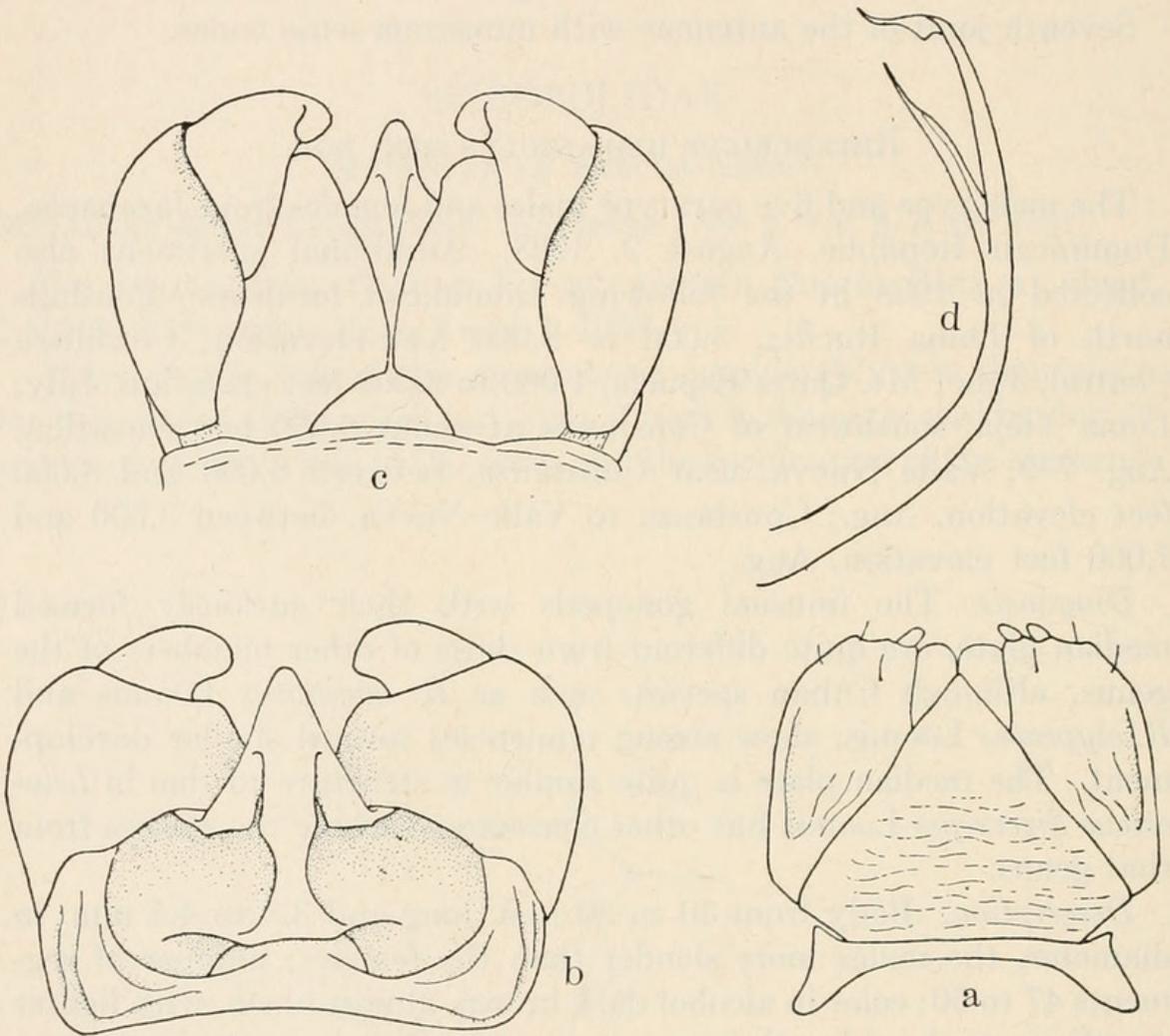


Fig. 12. *Rhinocricus hispaniolus*. a, Gnathochilarium; b, Gonopods, anterior view; c, Gonopods, posterior view; d, Apical portion of inner gonopod, same scale as b and c.

Principal body segments have mid-belt a third longer than the other two belts; the fore-belt usually separated from the mid-belt by a lightly impressed sulcus in front of which the surface is very faintly striate with fine lines; scobinae lacking; beginning on segment 2 the mid- and hind-belts are separated by a strong and abruptly impressed sulcus in full evidence to the penultimate segment on which it is variably impressed, the sulcus usually straight in passing behind the small pores which are somewhat conspicuous from being at the

bottom of a distinct pit; lateral sulcus seldom in evidence at the line of the pores; surface of mid- and hind-belt shining and apparently smooth but close inspection shows tiny fine aciculations; ventral striae entirely beneath the legs in ventral view, coarser and more extensive on the hind-belt than on preceding belts; last segment with apex somewhat produced but not surpassing the anal valves.

Anal valves not strongly convex, the margins appearing a little raised and sometimes set off by a distinct furrow; preanal scale triangular, the posterior margins converging in straight lines to the acutely rounded apex.

Gonopods as shown in figure 12, *b*, *c*, and *d*.

Anterior male legs stouter than those following the gonopods; joint 2 of the second legs enlarged, inwardly flattened, the posterior corner produced into a small rounded lobe; coxae of legs 3 to 7 inclusive produced into thickened conical lobes increasing in size to the seventh legs.

Ventral surface of seventh segment of male slightly raised into a thick transverse crest not excavated in front and scarcely concave for the accommodation of the gonopods.

#### RHINOCRICUS ARBOREUS (Saussure)

*Spiroboldus arboreus* Saussure, *Linnaea Ent.*, Vol. 13, p. 331, 1859.

Three females Maricao Forest, western Puerto Rico, June 1938 at 2,500 feet.

#### ALCIMOBOLUS ANGUSTIPES Loomis

*Bull. Mus. Comp. Zool.*, Vol. 80, No. 1, pp. 57-58, 1936.

Specimens collected in Dominican Republic, July 1938, at Sanchez; Villa Altigracia; and Mt. Diego de Ocampo, Northern range at an elevation between 3,000 and 4,000 feet. Additional specimens from Mt. Is. de Torres, Puerto Plata, in September 1938. In the U. S. National Museum collection of millipeds are three males and a female from Rio San Juan, March 1928.

Included in the above are specimens greatly increasing the size given in the original description, the largest female being 110 mm. long and 13 mm. in diameter, the largest male 85 mm. long and 9 mm. in diameter. In all the males the tips of the gonopods project outside the body cavity, approximating the tips of the coxae of adjacent legs.

## TRIGONIULUS LUMBRICINUS (Gerst.)

*Spirobolus lumbricinus* Gerstaecker, Gliederthier-fauna Sansibar, p. 516, 1873.

Sanchez and vicinity, Dominican Republic, July 1938.

## MICROSPIROBOLUS MARMORATUS Silvestri

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 571-572, 1908.

A single female from about 2,500 feet elevation, Maricao Forest, western Puerto Rico, June 2 and 3, 1938, collected with specimens of *M. insularis* Silvestri.

This specimen is referred with some doubt to the present species, although the last segment is typical, and the color, while generally darker, shows light yellow on the dorsum in spots and may be ascribed to age. If this specimen is correctly assigned, it is older and larger than the specimens Silvestri examined, being over 30 mm. long and with 50 instead of 37 or 38 segments. The segments are without any indication of transverse constrictions.

## MICROSPIROBOLUS INSULARIS Silvestri

Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 572-573, 1908.

Two males and several females from Maricao Forest, about 2,500 feet elevation, western Puerto Rico, June 2 and 3, 1938.

A male nearly 40 mm. long exceeds by almost 10 mm. the length given by Silvestri, but the other male is smaller and the gonopods of both agree with each other and with Silvestri's figure.

## MICROSPIROBOLUS SIGILLATUS Loomis

Smiths. Misc. Coll., Vol. 89, No. 14, pp. 20-21, 1934.

Three males and three females from Mt. Diego de Ocampo, Northern Range, 3,000 to 4,000 feet elevation, Dominican Republic, July 1938; collected with specimens of *M. signatus*.

## MICROSPIROBOLUS SIGNATUS spec. nov.

Two males (1 the type) and two females from Mt. Diego de Ocampo, Northern Range, between 3,000 and 4,000 feet elevation, July 1938, and two other pairs from Villa Altagracia, July 1938, Dominican Republic.

*Diagnosis.* The color pattern; limitation of the sulcus in the constriction to the dorsum and upper sides of the body; and the slight groove of the anal valves are outward characters distinguishing this species, but final identification must rest, as with many other members of the genus, on the peculiarities of the gonopods.

*Description.* Length of largest specimen, a female, 28 mm., diameter 2.5 mm.; males slightly shorter and relatively more slender than females, number of segments 40 to 44.

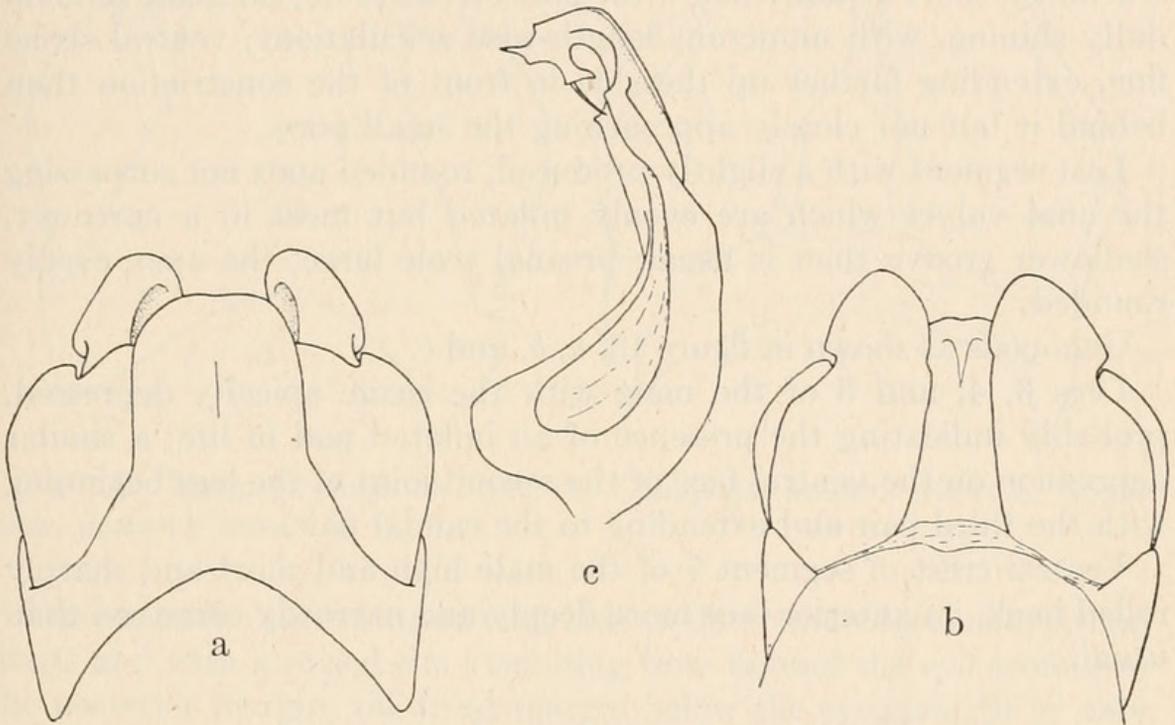


Fig. 13. *Microspirobolus signatus*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view; *c*, Inner gonopod, posterior view.

Head rather dark, a little lighter at clypeus; first segment encircled by white band twice as wide along front margin as elsewhere; central area dark brown or black; ensuing segments with a more or less continuous dark median line much the widest at the front of each segment and narrowing to a point at or near the back margin; laterad of this dark triangle, in front of the constriction, the color is dark with variable light mottlings but the constriction itself is narrowly white and behind it the surface is light reddish, becoming even lighter on the posterior segments; last segment with a transverse white spot in front extending from the dark median line to the ventral surface, the remainder of the segment solidly dark, contrasting sharply with the

lighter foregoing segments; anal valves dark above, lighter below and along the margins; preanal scale light.

Vertex of head with fine median furrow; ocelli strongly convex, numbering 28 to 37 in five or six series forming a nearly circular group.

First segment with the sides converging to the narrowly rounded lateral limits; margin with a strong narrow rim extending from behind the eye around to the posterior margin.

Beginning with segment 2 all but the last half dozen segments have a shallow constriction marked by a fine sulcus crossing the dorsum and reaching a short distance below the pore on each side; sides and dorsum dully shining, with numerous length-wise aciculations; ventral striae fine, extending farther up the side in front of the constriction than behind it but not closely approaching the small pore.

Last segment with a slightly produced, rounded apex not surpassing the anal valves which are evenly inflated but meet in a narrower, shallower groove than is usual; preanal scale large, the apex evenly rounded.

Gonopods as shown in figure 13, *a*, *b*, and *c*.

Legs 3, 4, and 5 of the male with the coxae apically depressed, probably indicating the presence of an inflated pad in life; a similar depression on the ventral face of the second joint of the legs beginning with the third pair and extending to the caudal pair.

Ventral crest of segment 7 of the male high and short and sharply rolled back, its anterior face more deeply and narrowly concaved than usual.

#### MICROSPIROBOLUS TENUIPES spec. nov.

Thirteen specimens of both sexes, including the male type, from between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, Cordillera Central, Dominican Republic, June 1938.

*Diagnosis.* The shape of the very thin, compressed gonopods offers the most satisfactory character for distinguishing this species from other members of the genus.

*Description.* Largest male, the type, 30 mm. long and 2.3 mm. in diameter, the females stouter, one of the same length being almost 3 mm. in diameter; number of segments 40 to 46.

Color in alcohol dark slate gray, at times with a slight tinge of deep red; a broad median spot of light color on the forebelt of each segment showing somewhat through the foregoing segment, especially its narrow, colorless, translucent posterior border; immediately behind the transverse constriction, a short distance on either side of the

middle of the dorsum, is a small elongate light spot either transverse or slightly inclined backward from the outer end; in younger specimens the light colored areas are larger but with less distinct limits.

Head with median furrow of vertex short and faint; eyes the size of the antennal socket or smaller, the ocelli relatively few, small and not distinctly elevated above surface of head, numbering 21 to 23 in five series.

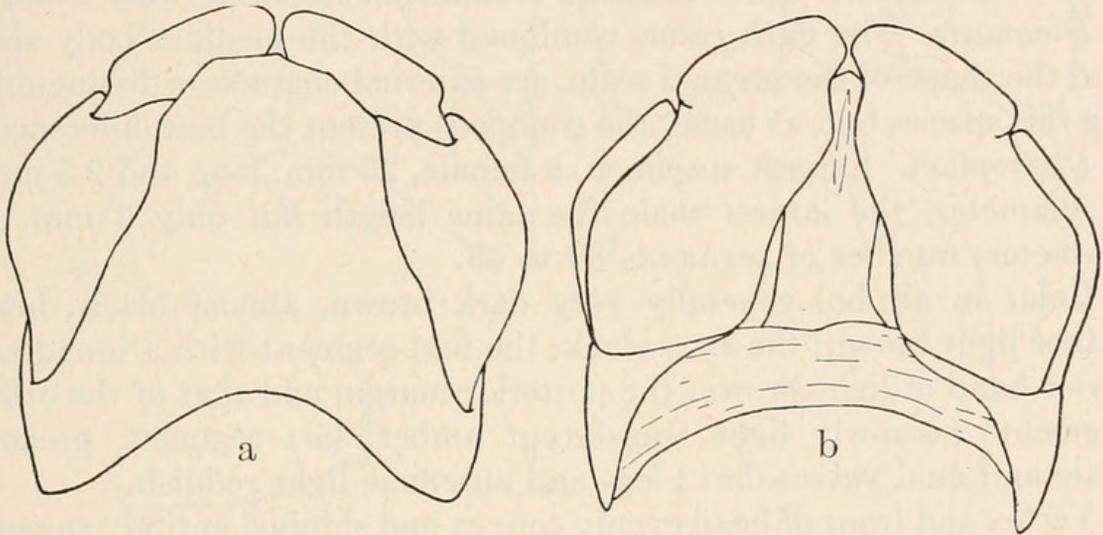


Fig. 14. *Microspirobolus tenuipes*. *a*, Gonopods, anterior view; *b*, Gonopods, posterior view.

First segment narrowing on each side to the rounded-truncate lateral limits and with a raised rim extending from behind the eye around to the posterior margin, the front margin below the eye straight or only slightly emarginate. Ensuing segments with a strong sulcus marking the transverse constriction from segment 2 to the last five segments where the constriction vanishes; pores of moderate size surrounded by a small impressed ring; dorsal surface of segments smooth and shining; ventral striae fine and confined to the lower surfaces except on a few of the anterior segments where short striae immediately behind the transverse sulcus exceed the tips of the legs but do not approach close to the line of pores.

Last segment produced to an acute point not surpassing the valves, the thick margins of which meet in a deep groove; preanal scale large, subtriangular, the sides straight to the rounded-acute apex.

Gonopods very thin, their anterior and posterior aspect shown in figure 14, *a* and *b*.

Ventral surface of segment 7 of the male raised at middle into a very thin, backwardly curved, lip-like ridge, broad and low on either side.

Males with the second joint of all but the first two pairs of legs with a depression along the ventral side indicating the presence of an inflated pad in the living animals, the legs normal in other particulars.

MICROSPIROBOLUS PULLUS spec. nov.

Four males (1 the type) and a female from between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

*Diagnosis.* The dark color, combined with the medium body size, and the shape of the preanal scale, are external characters distinguishing this species but, as usual, the gonopods present the best differences.

*Description.* Largest specimen, a female, 26 mm. long and 2.5 mm. in diameter, the largest male the same length but only 2 mm. in diameter; number of segments 39 to 43.

Color in alcohol generally very dark brown, almost black; head rather light brown; the eyes black; the first segment with a broad anterior band of light brown, the posterior margin and that of the other segments narrowly light translucent amber; last segment, preanal scale and anal valves dark; legs and antennae light reddish.

Vertex and front of head evenly convex and shining, entirely smooth or with only a fine short sulcus on the vertex; eyes composed of about 26 ocelli in a four-sided or sub-triangular group of five series, the individual ocelli convexly raised.

First segment with lateral limits short, obliquely truncated, the anterior corner forming a right angle or less, posterior corner much more obtuse; front border slightly emarginate below the eye and with a broad rim extending around to the posterior corner; just above the posterior corner one or two fine short striae usually proceed forward from the back margin.

Beginning with segment 2 the segments of the anterior half of the body have a strong constriction marked by a sharply impressed sulcus in and behind which rudiments of the ventral striae, decreasing in length, reach to the pores or slightly above them; on the posterior half of the body the constriction is evident on all but the last half dozen segments but is not marked on the dorsum by an impressed sulcus and the ventral striae are restricted to the lower sides of the body, adjacent to the legs; surface of segments smooth and shining; pores of medium size.

Last segment with apex slightly produced, sub-angular, but not surpassing the anal valves. Valves strongly shining and moderately convex, not margined. Preanal scale short, three times as broad as

long; in four specimens, including the type, it is shaped as shown in figure 15, *a*; in the other specimen it is more definitely triangular.

Gonopods as shown in figure 15, *b*, *c*, and *d*.

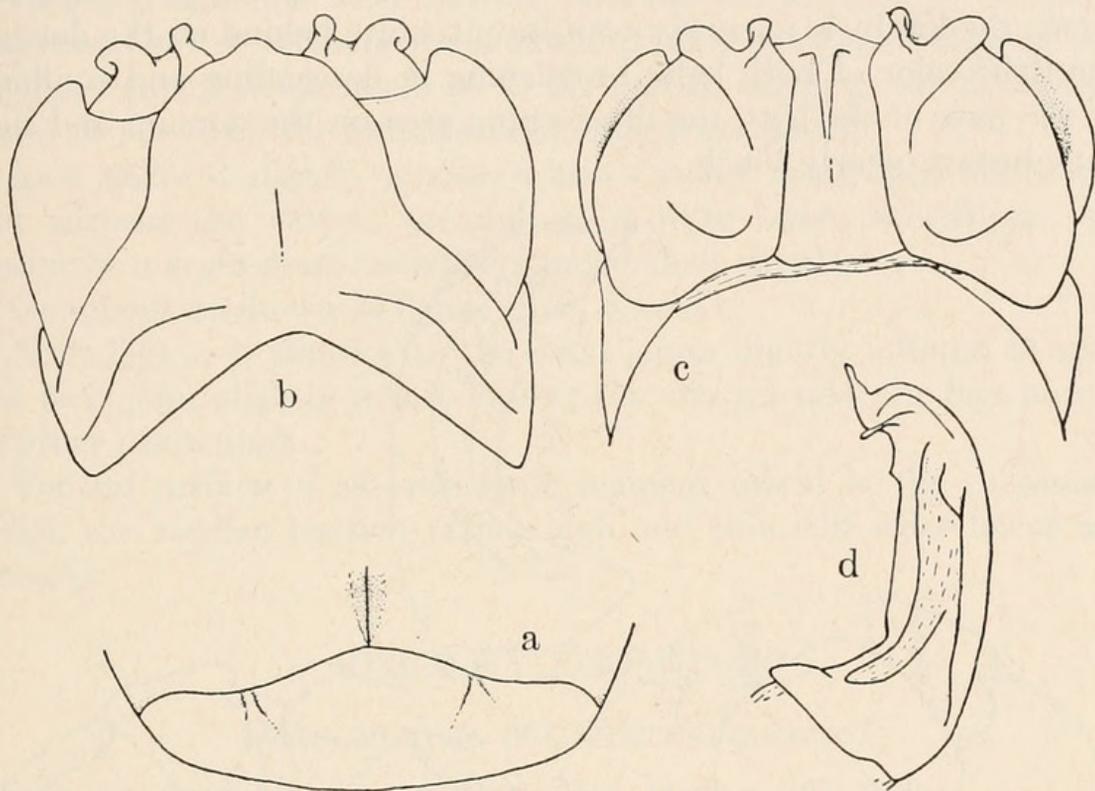


Fig. 15. *Microspirobolus pullus*. *a*, Preanal scale; *b*, Gonopods, anterior view; *c*, Gonopods, posterior view; *d*, Inner gonopod, posterior view.

Male legs 3 to 7 with coxae slightly swollen at apex but without distinct lobes; other joints normal.

Ventral surface of seventh segment of male raised into a transverse ridge, high and thin at middle, the sides lower and thicker.

#### MICROSPIROBOLUS INSTRATUS spec. nov.

One male (type) and four females collected with *M. pullus* between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

*Diagnosis.* This is the largest member of the genus thus far discovered in the West Indies. Its color pattern is distinctive, as also are its gonopods.

*Description.* Largest female 46 mm. long, 3.5 mm. in diameter and with 53 segments; male 34 mm. long, 2.3 mm. in diameter and with 46 segments, thus the males are slightly more slender than the females.

In alcohol the head is dark brown with the clypeal region a little lighter; segment 1 dark brown, nearly black, surrounded by a narrow light translucent border; ensuing segments with forebelt nearly white at the front of the dorsum where it is covered by the preceding segment, the hindbelt narrowly translucent white behind on the dorsum, the light color of both belts broadening in descending and confluent at the base of the legs, the intervening area on the dorsum and sides dark brown, nearly black.

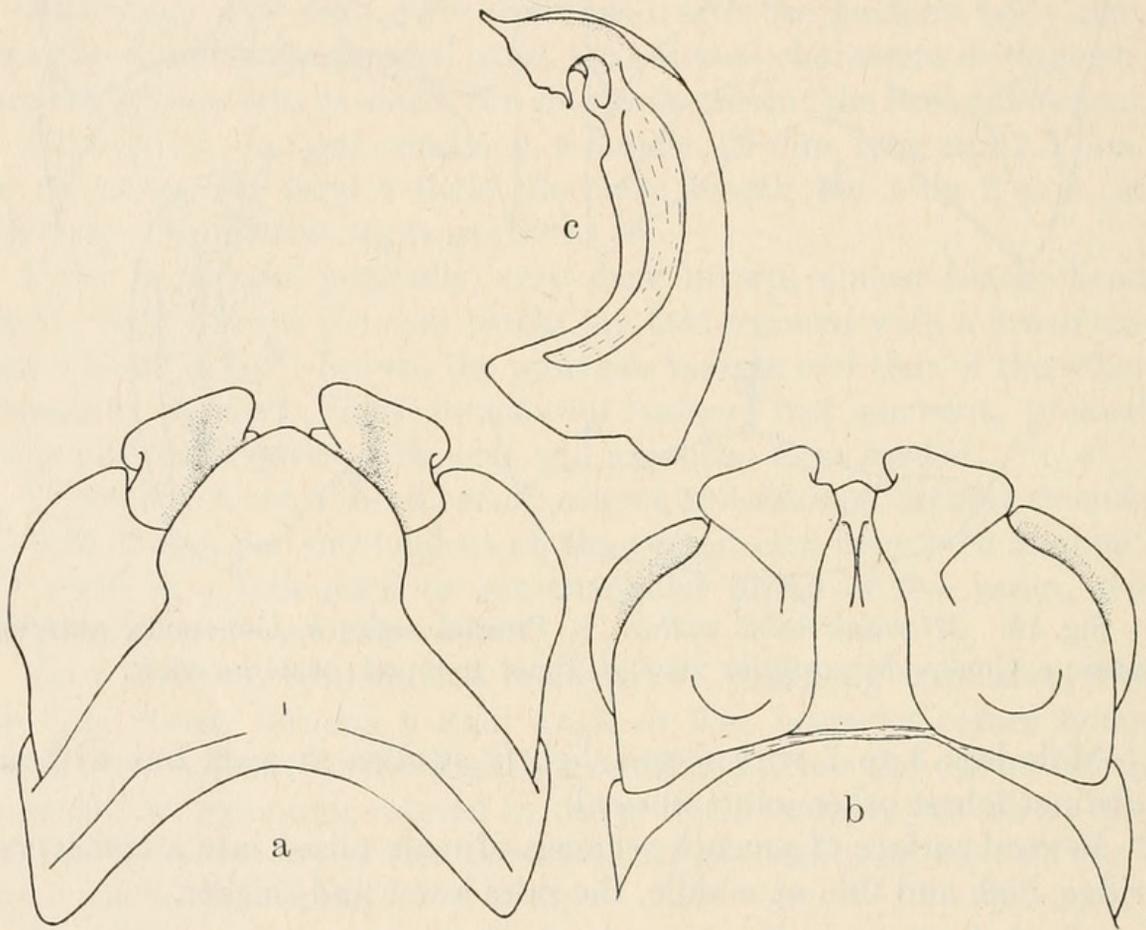


Fig. 16. *Microspirobolus instratus*. a, Gonopods, anterior view; b, Gonopods, posterior view; c, Inner gonopod, posterior view.

Head with a short, deeply impressed sulcus on the vertex and a smaller one on the front below the line of the antennae; eyes large, composed of definitely convex ocelli in five or six series, those of the type containing ocelli as follows: 4, 6, 7, 7, 7-5, 6, 7, 6, 5 for the two sides of the head, the largest female having ocelli 2, 6, 7, 7, 7, 6-3, 6, 7, 8, 7, 6.

First segment with sides converging to the rather narrow and sharply rounded lateral margin; front margin slightly emarginate

below the eye and bordered by a fine rim around to near the back margin; posterior margin with several fine striae proceeding forward a short distance just above the lateral limits.

Ensuing segments with a strong constriction marked by a sharply impressed sulcus crossing the dorsum of all but a few of the last segments; ventral striae much as in *M. pullus*, reaching the line of the pores or above on the anterior segments; pores small.

Last segment slightly produced into a rather acute apex which does not surpass the valves; preanal scale quite large, sub-elliptic, the posterior margin more broadly rounded than angular.

Gonopods as shown in figure 16, *a*, *b*, and *c*.

Male legs 3, 4, and 5 with the coxal joints slightly inflated at apex, the next joint slightly inflated along the ventral side, the legs normal in other particulars.

Ventral surface of seventh male segment raised in the customary ridge, the median portion rather high and thin, the sides lower and broader.

## STRONGYLOSOMIDAE

### ORTHOMORPHA COARCTATA (Saussure)

*Polydesmus coarctatus* Saussure, Mem. Myr. Mex., p. 297, 1860.

Specimens of this tropicopolitan species collected in the following localities of the Dominican Republic in 1938: Villa Altagracia; Santiago; Sanchez and vicinity; Puerto Plata; Monte Cristi.

## CHELODESMIDAE

### ACHROMOPORUS HETEROMUS spec. nov.

Three males (1 the type) and a female from Sanchez and vicinity, Dominican Republic, July 1938.

*Diagnosis.* The gonopods resemble those of *A. enneryensis* Loomis but are more slender; the dark color of the dorsum is more extensive than in the four other species; the difference in size of the poriferous and non-poriferous keels, especially in the males, is peculiar and suggested the specific name.

*Description.* Length 23 to 28 mm., the females more convex and robust than the males and with lateral keels smaller; males with sides scarcely narrowing after the third or fourth segment, almost parallel.

Head with vertex and front brown to the clypeal region; first seg-

ment dark brown with a white spot at middle along the front margin, a white band along the posterior margin, including the lateral angles, widest at the middle where it approaches, but does not join, the anterior spot; on the ensuing three segments the keels are dark brown except for the narrowly white outer and posterior margin including the posterior corner, the remainder of the dorsum white; on the other non-poriferous metazonites the keel is dark brown except for an area at the posterior corner smaller than that on segments 2, 3, and 4; poriferous metazonites wholly white above; sides below the keels of all segments dark brown; last segment brown on the sides; anal valves brown, the scale white; outer joints of legs and antennae pink.

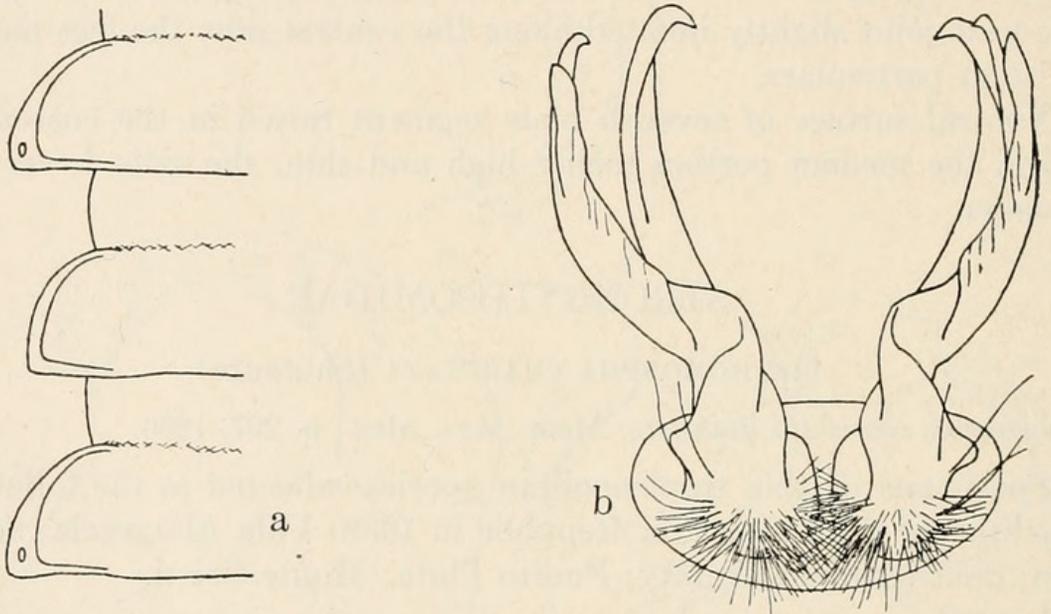


Fig. 17. *Achromoporus heteromus*. *a*, Segments 10 to 12, left hand half from above; *b*, Gonopods.

Surface of segments smooth and shining, the keels, especially the non-poriferous ones of the males, sometimes with several small faint tubercles, the one nearest the posterior corner most evident.

Poriferous keels of male broader than those lacking pores, as shown in figure 17, *a*; the same condition exists in the female but with the much smaller keels it is less striking; in the other species this condition is lacking or only faintly evident.

Preanal scale triangular, much as in *A. enneryensis*, the tip not noticeably prolonged.

Gonopods as shown in figure 17, *b*.

Coxae of second legs not elevated in the female but with a small conic corner in the male; third male legs with the sternum depressed

at middle but without special tubercles either side; male legs 3 to 7 with third joint indistinctly swollen on the under side as in *A. enneriensis*.

LASIOMAZUS genus nov.

*Diagnosis.* Considering the gonopods, the position of this genus appears closest to the Haitian *Achromoporus* Loomis rather than to any other American genus but even so the relationship is remote; the outer gonopods are more sharply bent and their two branches more diverse in size and shape, and the inner gonopods are unusually expanded; none of the legs or sterna has specialized swellings but both are remarkable in being abundantly decked with curved hairs.

*Description.* Body over 25 mm. in length, broadest at segments 1 to 3; dorsum smooth and shining, not greatly convex, the rather narrow lateral keels entirely above the middle of the body; pore formula normal.

Head deeply sulcate on vertex with two closely placed erect setae on each side of the furrow in front; surface in front of the antennae sparsely hispid; antennae moderately long and slender, joint 2 longest and almost glabrous; joints 3 to 6 nearly as long, subequal, much more pubescent, the density of the pubescence increasing on each succeeding joint.

First segment semicircular, with hind margin somewhat emarginate at middle, posterior corners slightly produced backward.

Segments 3 to 5 with a tiny tooth on each broadly rounded anterior corner; posterior corners of these and succeeding segments not caudally produced until after segment 15, the corners of segment 18 most produced, those of segment 19 very much smaller and scarcely exceeding the posterior margin; lateral keels narrow, rather thick, continuous with the dorsum and projecting from high above the middle of the body, the outer margin with a sharply defined rim which is slightly thickened around the pores, the pores opening obliquely outward and upward.

Last segment quite long and narrow, the slender apex scarcely deflexed.

Anal valves with rather thin margins strongly elevated; preanal scale large, triangular or angularly rounded behind.

Gonopods as shown in figure 18.

Sterna throughout body broad and densely beset with caudally curved hairs; similar hairs are present on the ventral surface of the joints of the legs; the legs and sterna in front of the gonopods slightly

stouter and with hairs longer and more dense than elsewhere, otherwise unmodified.

Type. *L. concolor* spec. nov.

LASIOMAZUS CONCOLOR spec. nov.

Male type and another male from Loma Vieja, near Constanza, about 6,000 feet elevation, Cordillera Central, Dominican Republic, Aug. 7 to 9, 1938.

Characters not given in the generic description are as follows: Length 26 to 28 mm., width 3.1 to 3.4 mm.; body widest at segments 1 to 3, narrowing gradually thereafter; surface of segments smooth and

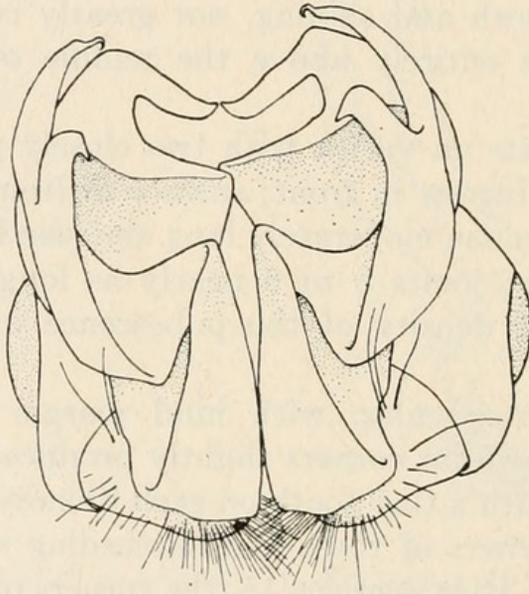


Fig. 18. *Lasiomazus concolor*. Gonopods.

shining, some of those at middle of body with a very shallow, indefinite transverse median depression; non-poriferous segments 8, 11 and 14 are slightly narrower than the adjacent poriferous ones; body colorless in alcohol except the light red antennae.

Legs throughout body with joints 1 to 4 nearly glabrous above, densely pubescent or hispid below; joints 5 and 6 completely hispid; the broad, hispid, sterna of each segment separated by a short glabrous space; sternum of the seventh male legs strongly depressed in contrast to the sternum of the sixth and foregoing legs; sternum of the pair of legs following the gonopods short and vertical.

## HYPSELODESMUS genus nov.

*Diagnosis.* The large, thin, ascending lateral keels of the segments, with a tooth at the anterior corner of all but those at the ends of the body; the indefinite but obvious transverse depression of the segments followed by a submarginal series of tubercles; and the structure of the gonopods show the remote association of this genus with other members of the family in the West Indies.

*Description.* Body of moderate size; the sides nearly parallel; color of the poriferous segments somewhat different from those lacking pores.

Head with a strong sulcus on the vertex, on each side of which are two erect, closely placed setae; antennae of moderate length, joints 2 to 6 inclusive of equal length with the inner joints almost as abundantly pubescent as joint 6; surface in front of the antennae with a few scattered, erect setae.

First segment short, subelliptic, the median portion of the posterior border slightly emarginate, the outer portion each side extending obliquely outward and forward to the acute corner.

Succeeding segments with the dorsum only slightly convex and, from segment 3 or 4 caudad, transversely crossed at middle by a broad, shallow, indefinite but obvious depression, behind which, close to the posterior margin, is a series of eight to ten small faint tubercles most distinct on the posterior half of the body; in front of the depression is a series of four to six less apparent tubercles; lateral keels rising from far above the center of the body and strongly ascending so that their outer margins are higher than the middle of the dorsum; the keels are thin, especially those without pores, and are unusually large, each extending outward a distance almost equal to the width of the dorsum itself, the raised rim along the three free margins strong; pores opening obliquely outward from the bottom of an elongate oval depression in the additionally thickened rim of the usual segments; from segment 2 to segment 15 or 16 a small acute tooth is present at the broadly rounded anterior corner of each keel; anterior segments with the posterior corners not surpassing the back margin but at segment 6 or 7 the corners begin to be acutely produced and this increases to segment 17 where the corners are very large and conspicuous, the corners on segments 18 and 19 reduced, those of segment 19 very small, hardly a third as large as those of segment 18; segments 3 and 4 with a fine bowed ridge low on each side just above the base of the legs, faint indications of a similar ridge present on segments 2 and 5 also.

Last segment quite long, with the produced apex slightly deflexed.

Anal valves rugose, the rather thick raised margins smooth and shining; preanal scale a little broader than long, almost evenly rounded behind from side to side.

Gonopods quite simple, each consisting of a distally slender sigmoid flexure curving out and around behind a short, stout, subcylindrical inner joint.

Second male legs with large seminal tubercles on the coxae; other legs and sterna without special modifications, the legs long and slender, far exceeding the sides of the body, joint 3 longest but almost equalled by the last joint; each sternum with six to ten erect setae on either side of the middle.

Type. *H. bicolor* spec. nov.

#### HYPSELODESMUS BICOLOR spec. nov.

Three mature males, including the type, and two immature specimens from between 1,000 and 3,000 feet elevation, Mt. Quita Espuela, Dominican Republic, July 1938.

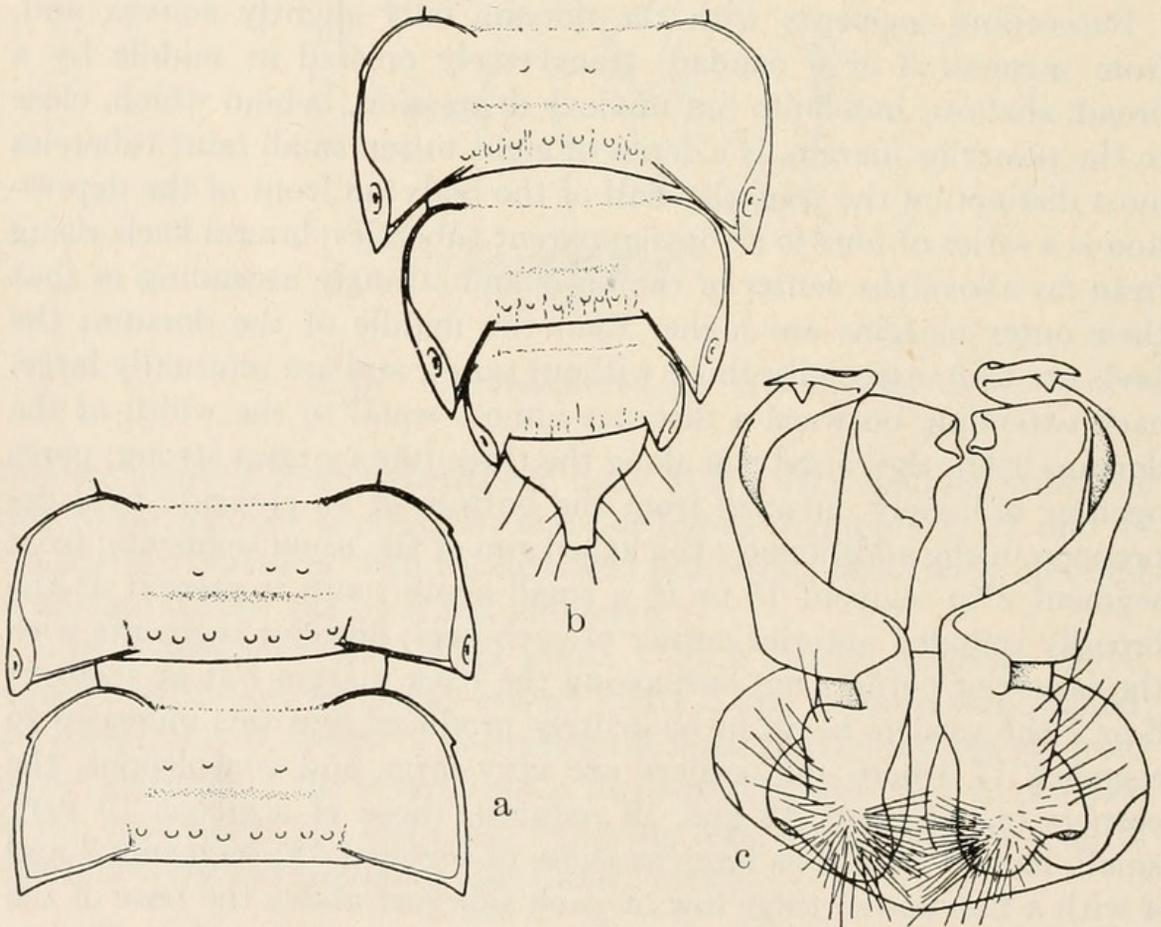


Fig. 19. *Hypselodesmus bicolor*. a, Segments 10 and 11, dorsal view; b, Segments 17 to 20, dorsal view; c, Gonopods.

*Description.* Length 29 mm, width 4 mm; body widest at segments 1 to 3.

Color dark brown except at the posterior corner of each keel which is white, the area of white being much larger and more intense on the poriferous segments than on those without pores.

Lateral keels large, as shown in figure 19, *a*, those at the posterior end of the body as shown in figure 19, *b*.

Gonopods as shown in figure 19, *c*.

Seminal duct opening from the very obliquely truncated inner face of a long cylindrical erect process rising from each coxa of the second legs.

Other characters are given in the generic description.

#### CYRTAPHE DOMINGENSIS spec. nov.

Many specimens of both sexes, including the male type, from between 3,000 and 4,000 feet elevation, Mt. Diego de Ocampo, Northern Range, July 1938, and other specimens from Mt. Is. de Torres, Puerto Plata, Dominican Republic, Sept. 1938.

*Diagnosis.* The shape of the gonopods definitely associates this species with *C. continuata* Loomis but the coloration of the body is different and there is less similarity in pattern between the poriferous and nonporiferous segments. The sterna between the third and fourth pair of legs, in the male, are without special swellings.

*Description.* Length 30 to 33 mm, females with the body thicker and the dorsum more convex than in the males and with the posterior corner of the keels less acute.

In alcohol the head is dark brown except in the clypeal region which is yellowish; first segment encircled by a white margin most extensive at the lateral angles but also somewhat broadened at the middle of the front and back margin; on ensuing segments the prozonite is brown with a large white spot at middle; metazonites on the non-poriferous segments dark brown with only the outer margin of the lateral keels white; poriferous metazonites of fully colored specimens lighter brown with the keels wholly white; in specimens not in full color segments 2, 3, and 4 have a broad continuous median band and ensuing poriferous metazonites may be white with only a dilute brown spot on each side of the dorsum in front; last segment brown except at the middle in front and at the tip.

First segment evenly rounded in front from side to side, the posterior margin medianly emarginate, lateral angles acute.

Segments 3 and 4 sometimes with a minute inconspicuous tooth on the rounded anterior corner of the keels.

Surface of segments smooth and shining except that the keels from segment 2 or 3 to segment 17 or 18 usually have two or three small, low, indistinct tubercles near the base.

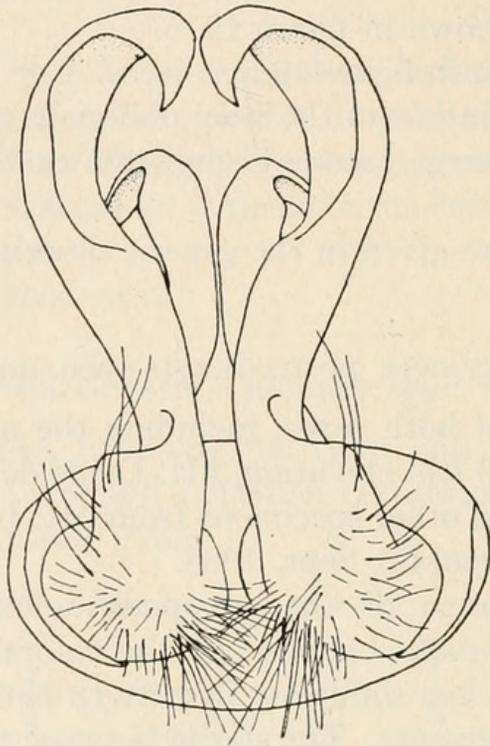


Fig. 20. *Cyrtaphe domingensis*. Gonopods.

Anal valves resembling those of *C. alternata* Loomis.

Gonopods as shown in figure 20.

Second male legs with the inner corner of the coxae rounded, not produced. Third sternum little narrower than in the female, lacking definite swellings as also does the fourth sternum; in general the sterna of the males are considerably more hispid than those of the females.

#### RICODESMUS STEJNEGERI Chamberlin

Three males, collected at about 2,500 feet elevation Maricao Forest, western Puerto Rico, June 2 and 3, 1938; many specimens of both sexes from El Yunque, Puerto Rico, May 1938.

A large female measure 30 mm long.

#### PODISCODESMUS genus nov.

*Diagnosis.* This genus seems more closely affiliated to *Antillodesmus* Chamberlin than to other known members of the West Indian fauna

but the small gonopods, while of somewhat similar form, distinguish it as also does the ridge on the side of the anterior segments immediately above the base of the legs.

*Description.* Body of intermediate size, with the dorsum strongly convex and the lateral keels projecting but a short distance from the sides; body widest at segments 1 and 2, the next three or four segments gradually narrowing, followed by poriferous segments which are uniformly wider than those lacking pores; poriferous segments no different in color from the others; segments smooth above except for slight rugulosity behind near the base of the keel.

Head with a pronounced median sulcus; antennae moderately long, joints 2 to 6 subequal in length with pubescence gradually increasing to joint 6.

First segment of semi-circular form as common in the family, the posterior border emarginate along the middle.

Ensuing segments with lateral keels projecting from above the middle of body, not following the descent of the dorsum but tending to rise to the horizontal; anterior segments lacking tooth at the front corner of the keels; posterior corner of the keels, to near the back end of the body, not produced backward as they are so distinctly in *Antillodesmus*, but those lacking pores sharper than where pores are present, the callus rounding the angle; posterior corners of segments 17 to 19 a little produced, those of segment 18 strongest, the keel on each side of segment 19 reduced to a small tooth projecting out and back from near the hind margin but not exceeding it; pore formula normal; lower sides of segments 3 to 11 with a sharply defined elevation immediately above the base of the legs, beginning as a sharp tooth on segment 3 and thereafter developing into a downwardly bowed ridge which later is reduced to a small tubercle near segment 11 before disappearing. In *Antillodesmus* this ridge is replaced by an indefinite, broad, low swelling with a few tiny granules scattered on the surface.

Anal valves rugulose, the raised margins smooth and shining; pre-anal scale quite large; rounded, rather than angular, behind.

Gonopods unusually small, straight and slender, their tips scarcely reaching the posterior edge of the sternum of the seventh legs, the basal joint not projecting outside the segmental aperture which is narrower than adjacent sterna.

Legs with joint 3 surpassing the others in length; a single long setae on the under side of joints 1 and 2, lacking from joints 3 and 4; sterna broad, low, glabrous; pregenital legs and sterna like the postgenital ones.

Type. *P. carinatus* spec. nov.

*PODISCODESMUS CARINATUS* spec. nov.

Two males, one the type, from Sanchez and vicinity, Dominican Republic, July 1938.

Length 25 mm, width 3.5.

In alcohol the head is dark brown gradually whitening at the labral region; antennae with basal joint white, the others gradually deepening in color to dark brown; legs entirely white; first segment reddish brown, the back margin lighter brown, widest at middle, lateral angles white; lateral keels of segments 2 to 4 white, thereafter the light color

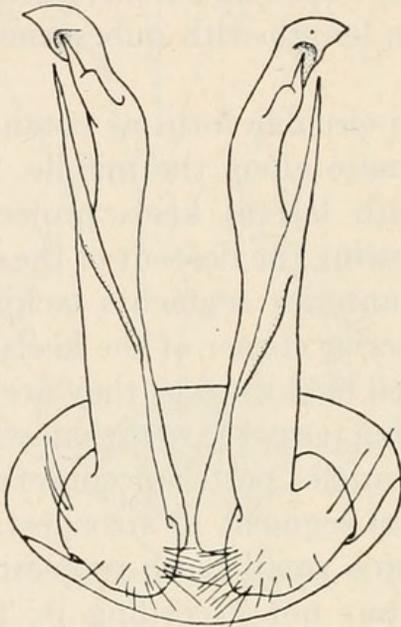


Fig. 21. *Podiscodesmus carinatus*. Gonopods.

gradually becomes more restricted to the posterior corner of the keels, the remainder of the dorsal surface reddish brown with a broad area of light brown (possibly white in life) along the middle of the posterior margin; last segment light reddish brown in front; white at the apex.

Head with a median sulcus at the bottom of a more general depression of the surface; front below the antennae sparsely beset with erect setae.

On either side of segment 3 just above the base of the legs an acute tooth projects caudo-laterad, its free apex equalling the posterior margin; on the next three segments this tooth is replaced by a downwardly bowed longitudinal ridge, largest on segment 6 after which it gradually lessens in size, becomes a small tubercle and finally vanishes at segment 11 or 12; pores opening obliquely outward from a large, elongate callus or thickening of the marginal rim.

Last segment quite long, the slightly deflexed apex rather suddenly constricted.

Gonopods as shown in figure 21.

CRATERODESMUS genus nov.

*Diagnosis.* This is an unusually stout-bodied genus with no close relatives known in the West Indian fauna. The swollen preanal scale probably is a generic character and of diagnostic value but most important are the gonopods which are notably different from other recognized genera.

*Description.* Size large, body stout and convex, much like *Fontaria* but the lateral keels are narrower and on all but the most anterior and posterior segments are well separated from each other; surface shining,

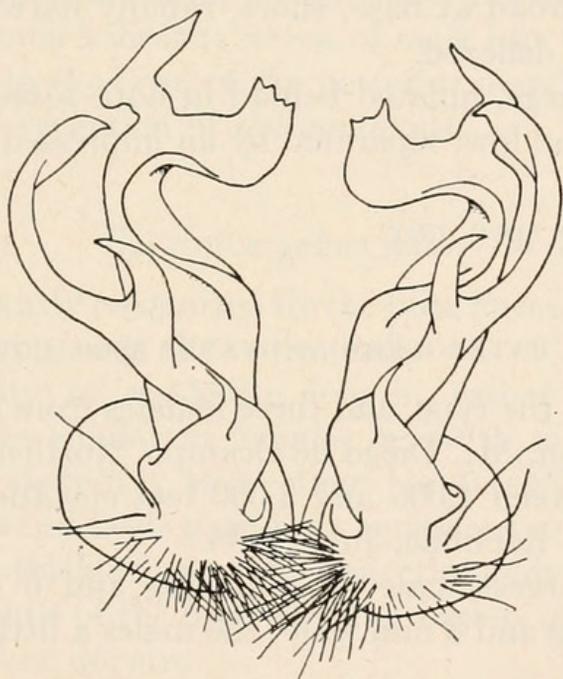


Fig. 22. *Craterodesmus ovatus*. Gonopods.

almost smooth except for a few fine wrinkles and two transverse rows of what appear to be follicles on the keels and adjacent dorsum; poriferous metazonites almost colorless, the non-poriferous metazonites mostly dark brown with lighter margins.

Head with a strongly impressed furrow across the vertex and a pair of erect setae on each side opposite its middle; surface in front of the antennae sparsely hispid; antennae slender and moderately long, joint 2 longest, the next four joints of subequal length; joint 6 slightly broader distally than the other joints.

First segment narrowly transversely elliptic with the back margin broadly concave at middle; lateral angles acute with front and back margins bordered by a raised rim for over half way to the middle of the dorsum.

Ensuing several segments with lateral keels overlapping slightly, followed by segments where the keels are definitely separated but on the last few segments some overlapping occurs; anterior corner of segments without a tooth, the posterior corners not produced backward except moderately so on the posterior segments; segment 19 with the lateral keels scarcely indicated, the posterior angles tiny; pores in normal arrangement, opening almost vertically from a gradually much expanded and flattened posterior part of the margining rim; anterior spiracle on each segment preceded by an especially high, thin crest, in outline almost an equilateral triangle.

Last segment broad at base, short, rapidly narrowing to the short apex which is not deflexed.

Preanal scale large, inflated behind in both sexes.

Sterna broad and low, separated by an impressed line only near the sides.

Type. *C. ovatus* spec. nov.

#### CRATERODESMUS OVATUS spec. nov.

Two males, one the type, and three females from between 3,000 and 4,000 feet elevation, Mt. Diego de Ocampo, Northern Range, and five females from between 1,000 and 3,000 feet elevation, Mt. Quita Es-puela, Dominican Republic, July, 1938.

*Description.* Largest male 35 mm long and 6 mm wide; largest female 42 mm long and 8 mm wide; the males a little less convex than the females.

Head dark brown on the vertex and in a narrow median line extending between the antennae to the labrum where it broadens slightly; sides of head, antennae, legs and ventral surface of body uncolored; first segment margined with white, broadening in front and back at the middle, inner area moderately dark brown; next three segments with a large dark brown spot on either side partly on the dorsum and partly on the keel, the two spots joined by a lighter band of brown suffusing the junction of the zonites, remainder of segment white; on ensuing prozonites there is a small light brown spot below the line of the keels and a larger darker spot above it; poriferous metazonites almost colorless; those without pores colorless along the back

margin and up the outer margin of the keel, the posterior band widest at the median line; remainder of zonite dark brown on the sides, lighter toward the middle; last segment with apex and a spot on each side in front light brown.

In addition to the structural characters given in the generic description it may be noted that the anal valves are slightly coriaceous, with thick, high, shining margins; preanal scale transversely oval in outline, the surface low in front adjacent to the last segment but thereafter suddenly inflated, the swollen posterior face of which bears the customary two setae widely separated.

Near the legs the anterior spiracle is definitely larger than the posterior one and is immediately preceded by a short, thin, high, angular crest absent from the posterior spiracle.

Gonopods large and conspicuous, shaped as shown in figure 22.

Third joint of legs immediately before and after the gonopods with a slight bend or umbo beneath; sterna of male legs 5 to 7 broadly depressed at middle to the level of the posterior margin of the segment, apparently for the reception of the gonopods.

#### BIAPORUS genus nov.

*Diagnosis.* Instantly recognized by the pore formula which is unique in the family if not also in the entire order.

*Description.* Body of moderate length, rather slender; females parallel-sided, males similar to females in width to segments 15, 16, and 17 which are definitely wider than the foregoing segments and more depressed; lateral keels narrow as compared to most other members of the family, thick at base and projecting only a little way from high above the middle of the body and continuous in contour with the smooth, quite convex dorsum.

Head with furrow of vertex long and strongly impressed; one or two erect setae on either side of it in front; surface below antennae rather sparsely hispid; antennae of moderate length, the second joint longest, sparsely pubescent, the pubescence increasing on succeeding joints.

First segment smaller than in many genera of the family; semi-circular; the back margin almost straight across, only faintly emarginate at middle.

Segments 2 to 5 with anterior corners of the keels abruptly rounded and each with a tiny tooth; succeeding keels more broadly rounded at the anterior corner and toothless; posterior corners of keels almost right angles, first produced backward on segment 16 but even on segment 18,

where the angles are more produced, they are short and not very acute, those of segment 19 much smaller but relatively more acute, the whole segment much narrower than segment 18; last segment short, with a series of four erect setae across middle and two others at base of the apex which is short and slightly deflexed; pores small, opening obliquely outward from a depression in the somewhat expanded rim of the keel close to the posterior angle on segments 5, 7 to 13, and 15 to 19, thus segments 6 and 14 are poreless.

Anal valves with rather thin and not greatly elevated margins, preanal scale large, subtriangular, the apex slightly produced as in several species of *Achromoporus* Loomis; two setae in the margin adjacent to the apex.

Legs with joint 3 definitely longer than any other joint.

Gonopods as shown in figure 23.

Type. *B. montanus* spec. nov.

#### BIAPORUS MONTANUS spec. nov.

A male (type) and a female from Pico del Yaque, Loma Rucilla, 8,000 to 10,000 feet elevation, Cordillera Central, Dominican Republic, June 1938; another female from the mountains north of Loma Rucilla between 5,000 and 8,000 feet elevation the same month.

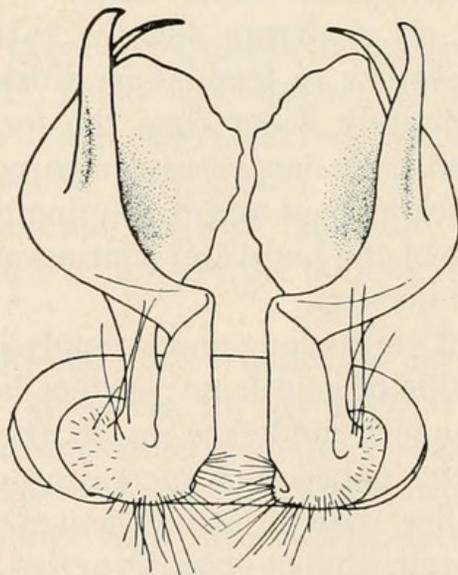


Fig. 23. *Biaporus montanus*. Gonopods.

The following characters were not mentioned in the generic description. Length 22 to 24 mm, width 2.7 to 3 mm; color apparently white or nearly so in life, very light brown in alcohol; surface of body smooth

and shining; anal valves slightly coriaceous with the raised margins smooth and shining; preanal scale smooth; male legs in front of the gonopods stouter than those following and with the upper surface of the second joints more swollen, the sterna and ventral surface of these legs sparsely beset with long erect hairs, the other legs and sterna and all those of the females with almost no setae, those present being much smaller than the anterior ones of the male.

SYNECHEPORUS genus nov.

*Diagnosis.* Insofar as I am aware no other member of the Chelodesmidae has as continuous a pore formula as the present genus, in fact one of the most constant characters of the family is the normal, discontinuous pore formula. Hence, it is remarkable to find two genera, the present one and the foregoing in the same region, both exhibiting departures from the usual formula.

*Description.* Body of moderate size, over 20 mm long; widest at segments 16, 17, and 18; males similar to females in size and shape; dorsum smooth and shining, only slightly convex, the lateral keels projecting a short way from the sides well above the middle of the body; a few segments at the anterior end of body with a small tooth at the front corner of the keels.

Head with long, deep, median furrow on the vertex on either side of which, in front, are five to ten erect setae; surface below the antennae evenly convex and scattered with many erect setae; antennae of moderate length; joint 2 slightly longer than any of the four subequal joints ensuing, first joint glabrous, those thereafter increasingly pubescent; antennae of male a little stouter than those of the female.

First segment semi-circular with the back margin slightly emarginate at middle.

Segments 2, 3, and 4 shorter than those that follow; from segment 2 to the middle of the body the posterior corner of the keels is nearly a right angle but thereafter it is slightly produced, becoming strongly so on segments 17 and 18, particularly the latter, where each corner is broadly triangularly produced; segment 19 with the posterior corners greatly reduced in size; segments 16 to 18 wider than any others and with the dorsum flatter; pores small and opening almost straight upward from a definite depression in the expanded raised rim of segments 5 and 7 to 19 inclusive.

Last segment with a dorsal row of four setae across the middle and two other setae near the apex which is produced backward but not deflexed.

Anal valves with rather thin raised margins; preanal scale subtriangular, its posterior margin suddenly thickened.

Legs with the third joint definitely longer than any other.

Gonopods as shown in figure 24.

Type. *S. platyurus* spec. nov.

*SYNECHEPORUS PLATYURUS* spec. nov.

Six males (one the type) and four females from Pico del Yaque, Loma Rucilla, between 8,000 and 10,000 feet elevation, Dominican Republic, June 1938; other males and females from Loma Rucilla and mountains north, 5,000 to 8,000 feet elevation, the same month.

Characters not given in the generic description are as follows: Body from 21 to 25 mm long and up to 3.5 mm wide. Color probably white in life, rather light brown in alcohol, apparently stained.

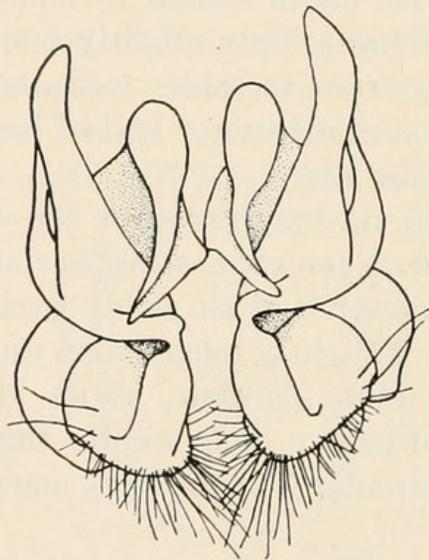


Fig. 24. *Synecheporus platyurus*. Gonopods.

Beginning at segment 2 and extending to segment 5, 6, 7, or even to segment 8, a small tooth is found on the rounded anterior corner of each keel; from segment 5 to 19 inclusive only segment 6 is without pores; preanal scale subtriangular with the apex produced slightly as that in *Achromoporus* Loomis; the entire back margin suddenly thickened, lowest and narrowest at the sides, highest and broadest at the apex, near each side of which an erect seta projects from the thickened margin.

Male legs 3 to 7 with the second joint swollen next to the body, the other joints also a little stouter than on ensuing legs; sterna and ventral surfaces of the legs in front of the gonopods beset with long hairs; all sterna and legs of the females and those of the male, following the gonopods, with a few scattered hairs.

## POLYDESMIDAE

### CRYPTOGONODESMUS Silvestri

*Cryptogonodesmus* Silvestri, Anal. Mus. Nac. Buenos Aires, Vol. 6, pp. 59-60, 1898.

*Chilaphrodesmus* Loomis, Smith, Misc. Coll., Vol. 89, No. 14, pp. 42-43, 1934.

There appears to be no doubt as to the correctness of the above synonymy.

### CRYPTOGONODESMUS RUBELLUS (Loomis)

*Chilaphrodesmus rubellus* Loomis, Smiths. Misc. Coll., Vol. 89, No. 14, pp. 42-44, 1934.

A female from between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, Cordillera Central, Dominican Republic, June 1938.

### CRYPTOGONODESMUS DARLINGTONI spec. nov.

One male (type) and three females from Loma Vieja, south of Constanza, elevation about 6,000 feet, Cordillera Central, Dominican Republic, August 1938.

*Diagnosis.* A larger species than *C. rubellus* and with the outer margin of the keels smoother, their posterior corners less acutely produced. The gonopods further distinguish it from *rubellus* as well as from the South American species.

*Description.* Length 7.5 mm; color in alcohol light brown; with sufficient magnification the entire dorsal surface of the metazonites and the exposed portion of the prozonites is seen to be densely covered with fine smooth granules of uniform size; dorsum of the segments with the quadrate areas separately elevated and easily distinguishable; dorsal setae of segments 2 to 19 in three transverse series,

four in the front series, six in each of the following series, those of the last series projecting backward from the straight and smooth posterior margin; outer margin of the lateral keels not dentate or serrate as in the other species, smooth or at most slightly undulate at the marginal setae of which there are three on the nonporiferous segments and four on those with pores.

Antennae much like those of *C. rubellus* but possibly a little more slender.

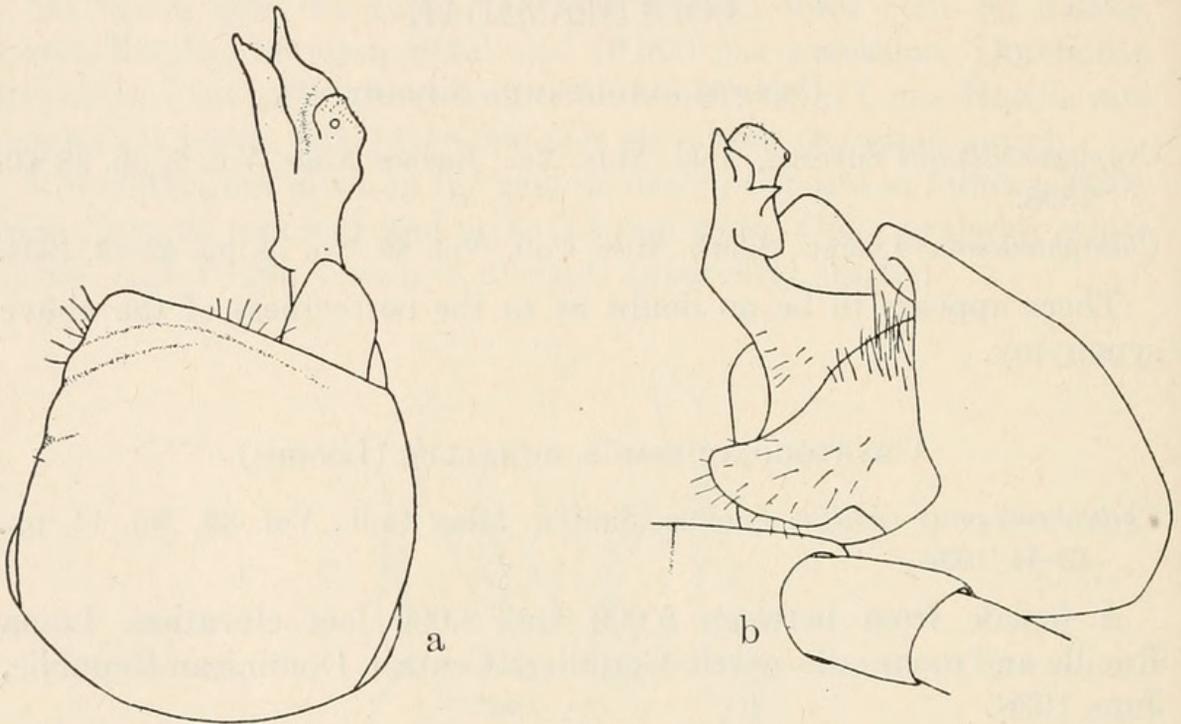


Fig. 25. *Cryptogonodesmus darlingtoni*. *a*, Gonopod, oblique lateral view; *b*, Gonopod, posterior view.

First segment nearly semi-circular in outline, the front margin broadly rounded, the back margin almost straight, faintly bisinuate; surface with setae as in *C. rubellus*, an anterior row of ten, a median row of four, and a posterior row of six setae.

Second segment with lateral keels directed farther forward than in the other species, the outer margin rounded and without definite anterior or posterior corners; keels of segments 3 and 4 also somewhat carried forward, rounded at the anterior corner but with the posterior corner marked by the small tooth bearing the last of the three marginal setae; the other nonporiferous segments have similar posterior corners on the keels which are much less conspicuous than those of *C. rubellus*, and there is only a tiny sinus or emargination at the base of each keel

behind; poriferous segments with the posterior corners blunter than those of *C. rubellus* and with the pores opening obliquely backward from between the last two marginal setae much as in *C. brevicornis* Carl, the pores scarcely dorsal.

Segments 18 and 19 with the poriferous corners much more slender and acute than those of preceding segments, moderately produced beyond the straight posterior margin.

Gonopods as shown in figure 25, *a* and *b*.

Legs and sterna on both sides of the gonopods without special modifications.

## CHYTODESMIDAE

### *Key to the West Indian Genera of Chytodesmidae*

- Pore formula irregular, the pores present on segments 5, 10, 13, 16, 17, 18, and 19. . . . . *Henicomus* gen. nov.
- Pore formula normal, the pores present on segments 5, 7, 9, 10, 12, 13, 15, 16, 17, 18, and 19. . . . .
- First segment with the posterior margin coarsely scalloped. *Lobodesmus* Loomis
- First segment with the posterior margin simple or very indistinctly scalloped. . .
- Segments with slender tubercles bent toward rear. . . . . *Cyphotylus* Loomis
- Tubercles usually low, often indistinct, never raised and bent backward. . . . .
- First segment elliptical or oval in outline. . . . . *Coccoelasma* Loomis
- First segment with front margin rounded but hind margin definitely angled. . .
- Body very strongly arched, the lateral keels sharply descending. . . . .  
*Iomoides* Loomis
- Body slightly arched at most, lateral keels nearly horizontal. . . . .
- All margins of the lateral keels with conspicuous lobes between deep incisions  
*Iomus* Cook
- Keels with not more than one margin having strong lobes separated by deep incisions. . . . .
- Posterior margin of lateral keels with one or two large lobes bounded by deep incisions. . . . . *Melanodesmus* gen. nov.
- Outer and usually the posterior margin of the keels with small scallop-like lobes none of which are separated by deep incisions. . . . .
- Poriferous keels of segments 7, 9, 10, 12 and 13, with three scallop-like lobes on the outer margin. . . . . *Tridesmus* Cook
- Poriferous keels of above segments with four lobes instead of three on the outer margin of each segment. . . . . *Docodesmus* Cook

## DOCODESMUS ALIFER spec. nov.

Female type and another female from Pico del Yaque, Loma Rucilla, 8,000 to 10,000 feet elevation, Dominican Republic, June 1938.

*Diagnosis.* This is a most unusual species in that the lateral keels, instead of descending or being held horizontally, are strikingly elevated, with their outer margins as high or higher than the middle of the dorsum. Also the dorsum is less sculptured than in any other known species.

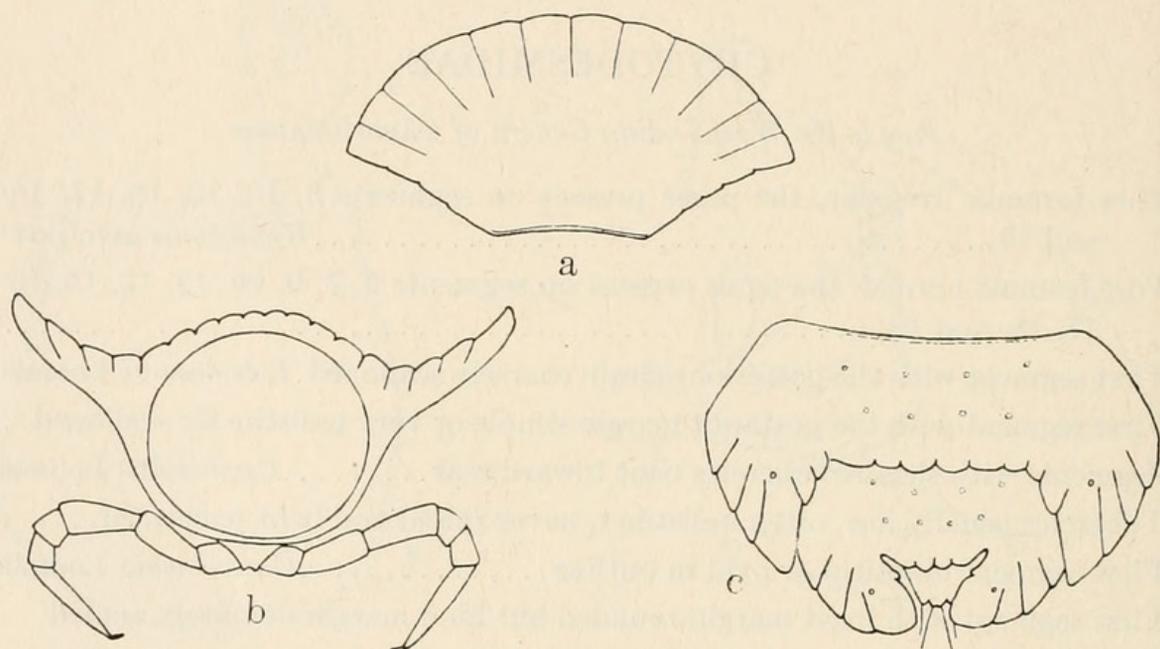


Fig. 26. *Docodesmus alifer*. a, Segment 1, dorsal view; b, Segment 4, posterior view; c, Segments 18 to 20, dorsal view.

*Description.* Length 16 to 17 mm, width 3 mm. Both specimens light brown, probably white in life from which it may be inferred that maturity had just been reached before capture, as brown to almost black is the usual color of old specimens in the genus.

Head with the antennae slightly longer and more slender than in other large species, joint 5 considerably the longest, exceeding joints 6 and 7 together; surface in front and to the side of each antenna raised into a broad low ridge behind which the basal joints of the antenna lie when at rest.

First segment quite long as shown in figure 26 a, its latero-posterior margins slightly scalloped, very oblique, longer than the median portion which is almost straight and bordered by a raised rim; anterior

expanded margin raised much higher than the central region, its quadrate areas much longer than broad, especially the outer ones; central region nearly flat, almost smooth, the usual tubercles very faintly indicated by tiny low swellings.

On ensuing segments the lateral keels are thin and extend obliquely upward far from the sides of the body, the outer margins as high or even higher than the dorsum itself, as shown in figure 26 *b*; inner area of each keel depressed below its margins; non-poriferous segments and segment 5 with 3-lobed keels, the other poriferous segments with 4-lobed keels, none of the outer margins strongly scalloped as are the posterior margins of the keels and the dorsum; the sulci separating the marginal areas of the keels and dorsum well impressed, constituting the most conspicuous sculpturing of the segment, as the usual transverse areas of the dorsum are but faintly indicated, if at all, and the central tubercle of each area is almost obliterated; the entire surface dully shining and less sculptured than in any other known species; raised rim at the front of each segment low, thin and inconspicuous on the dorsum as well as on the keels.

Penultimate segment with keels slightly raised, unusually large as compared with those of other species, produced backward and sharply inward, the sinus between them wide in front but narrow between the blunt tips of the keels as shown in figure 26 *c*.

Last segment small, much exceeded by the keels of the penultimate segment; without dorsal tubercles but with two small apical lobes and another small lobe on either side.

Ventral ridge of the third segment narrow and high, rising to a median point, thus it is triangular in outline and is inclined toward the rear.

#### DOCODESMUS GRISEUS spec. nov.

A dozen specimens, including the male type, collected at Sanchez and vicinity, Dominican Republic, July 1938.

*Diagnosis.* The smaller size, lack of secondary tubercles on the dorsum, the greater accentuation of the primary ones, and the more acute keels at the posterior end of the body distinguish this species from *D. haitiensis* Chamberlin. The males have the keels of segments 2, 3, and 4 distinctly lifted above the horizontal and the coxae of the fourth legs have hispid swellings not found in other species.

*Description.* Body up to 14 mm. long and 3 mm broad; color nearly white to light grayish brown in alcohol.

Head with antennae white, quite long and slender, joint 5 longest and broadest; surface above the antennae finely granular, median channel faint; surface between and below the antennae smooth, shining, and finely hispid, the clypeal region only slightly inflated but laterad of each antenna a broadly swollen ridge is present.

In general the shape of the body and of the individual segments, their position and sculpturing resemble *D. haitiensis* but the following differences are noted. In the males the keels of segments 2, 3, and 4

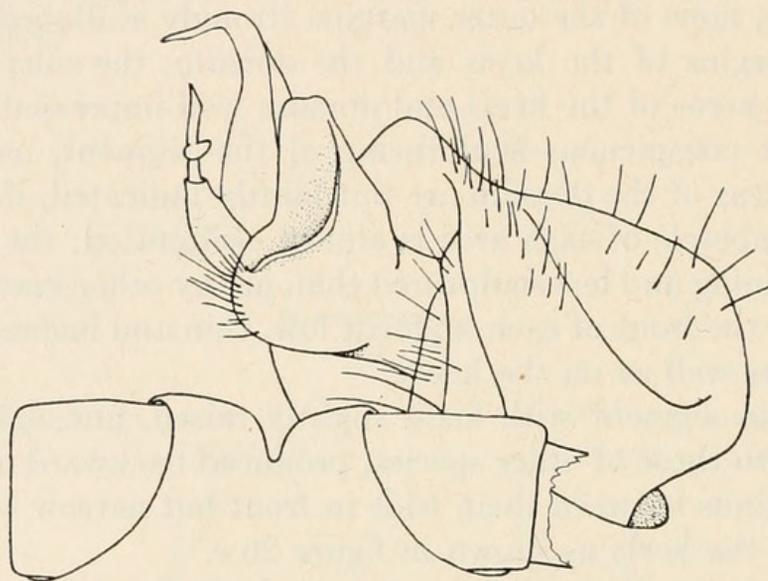


Fig. 27. *Docodesmus griseus*. Right hand gonopods with sternum and coxal joints of ensuing legs.

are obliquely raised a little above the horizontal; the posterior segments of both sexes have the keels produced farther backward and more acute; quadrate areas of the dorsum with the central tubercle larger, no additional smaller tubercles present; raised ridge across the front of each metazonite as high or higher than in *D. haitiensis* and more irregular at apex.

Anal valves notably flattened, especially near the scale, the margins lower and broader than usual; surface, and that of the scale, smooth and shining.

Gonopods as shown in figure 27.

Males with each coxal joint of the fourth legs bearing a broad, low swelling covered with fine erect setae.

Females with the ventral crest of the third segment higher than in most other species, thin, rising gradually from each side to the broadly rounded median portion; surface behind the crest low and nearly flat.

## DOCODESMUS HAITIENSIS Chamberlin

*Docodesmus haitiensis* Chamberlin, Bull. Mus. Comp. Zool., Vol. 62, No. 5, p. 216, 1918.

Two males and two females from Mt. Diego de Ocampo, Northern Range, elevation 3,000 to 4,000 feet, Dominican Republic, July 1938.

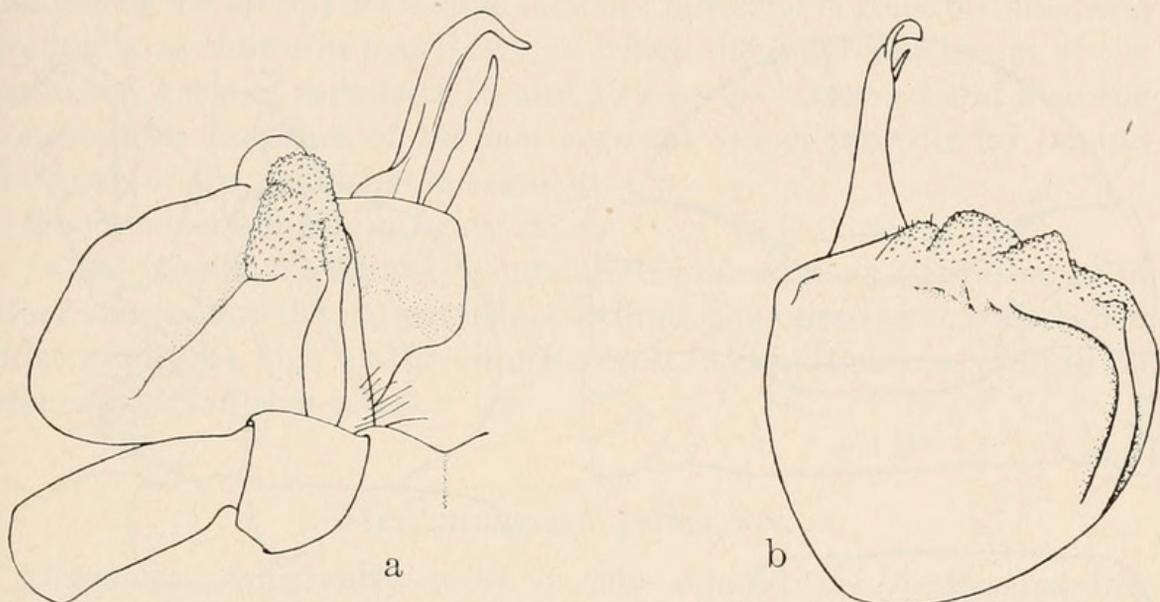


Fig. 28. *Docodesmus haitiensis*. a, Left hand gonopods, posterior view; b, Gonopod, lateral view.

While these specimens differ very slightly from typical *haitiensis* the differences appear too insignificant to justify recognition as even a variety.

A drawing of the gonopods of this species from a specimen collected at Trouin, Haiti, is shown in figure 28.

## DOCODESMUS ANGUSTUS spec. nov.

Four males, one the type, and eight females from Valle Nuevo, southeast of Constanza, elevation about 7,000 feet, Dominican Republic, August 1938; one male from rain forest near Valle Nuevo at about 6,000 feet elevation, August 1938; several males and females from Loma Vieja, south of Constanza at about 6,000 feet elevation August 1938; a male and female from between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, June 1938.

*Diagnosis.* The wide second segment, gradually attenuated pos-

terior end of body, and conspicuous lobes on outer margins of keels, are noteworthy characters supplementing those shown by the gonopods.

*Description.* Body quite slender for its size, the largest female being 18 mm long and 3.5 mm wide, the largest male 15 mm long and 2.7 mm wide; sides of body parallel from segment 2 to near the posterior end of body which narrows more gradually than in other known species; color in alcohol rather dark brown with the lateral keels a little lighter.

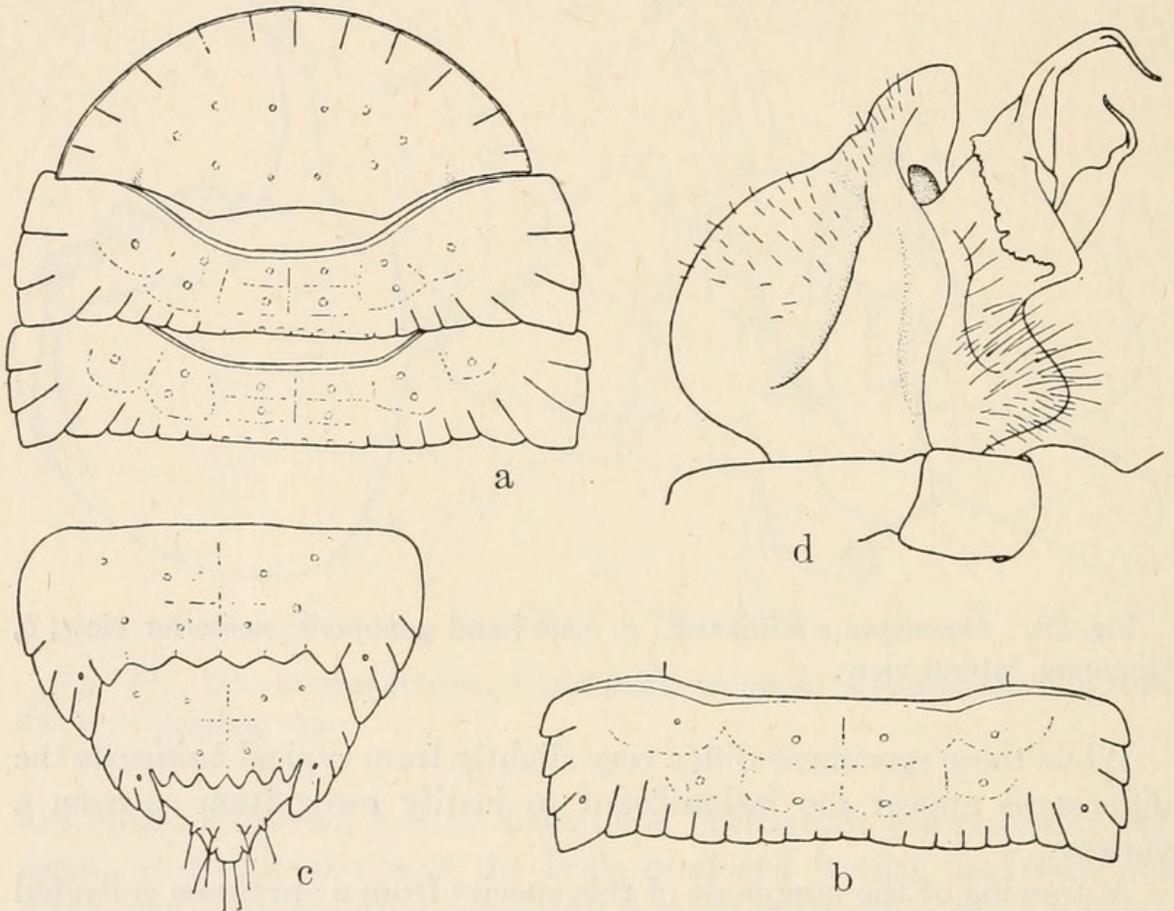


Fig. 29. *Docodesmus angustus*. a, Segments 1 to 3, dorsal view; b, Segment 10, dorsal view; c, Segments 18 to 20, dorsal view; d, Left hand gonopods, posterior view.

Head with antennae short and stout as in most species, the outer sides of the head in front of them swollen; vertex minutely granulose, the median furrow fine and short, stopping considerably above the antennae between and below which the surface is finely hispid.

First segment short and conspicuously narrower than segment 2 as shown in figure 29 a, the front margin evenly rounded without indication of scallops, but with a fine raised rim; dorsal sculpture of this and succeeding segments quite similar to, but not as strong as, that of the

much smaller *D. parvior*, shown in Bul. Mus. Comp. Zool., Vol. 80, No. 1, pl. 3, 1936.

All segments, except three or four at each end of body, have the outer margin of the lateral keels more definitely lobed than in other species as shown in figure 29 *b.*, the raised rim across the anterior border of each segment is fairly well developed on anterior segments but thereafter gradually diminishes and on the posterior segments is limited to the lateral keels or is lacking; posterior segments narrowing gradually as shown in figure 29 *c.*, in which the difference in size of the produced keels of segments 18 and 19 may be observed and also the considerable exposure of the last segment which projects far behind the keels of the penultimate segment.

Gonopods as shown in figure 29, *d.*

In the female the anterior ventral crest of segment 3 is raised as in other species but the entire surface behind it is raised into a thickened ridge almost as high as the anterior crest, a condition observed in no other species of this genus.

#### MELANODESMUS genus nov.

*Diagnosis.* Apparently most closely related to *Docodesmus* but differing in having the entire dorsum, including the tubercles, evenly finely granulose; and the posterior margin of each segment has two deep incisions at the base of the lateral keel, the intermediate margin a conspicuous lobe.

*Description.* Body of the shape and proportions of *Docodesmus*; black; the entire dorsum, including the large tubercles, finely and evenly granulose.

Head with the vertex finely granular, without a definite median furrow; surface between the antennae hispid, the clypeal region smooth and shining and somewhat inflated; antennae quite short and stout, quite densely pubescent.

First segment noticeably narrower than those that follow; shaped as in *Docodesmus* but the marginal areas less distinct and the margin more continuous; posterior margin with a small incision at the base of the expanded margin; central area with ten tubercles.

Ensuing segments with keels projecting outward almost horizontally from well above the middle of the body, the outer lobation of the keels as in *Docodesmus* but the front margin thicker; the posterior margin thin and with two wide and deep incisions having a prominent lobe between them at the base of the keel; dorsum with quadrangular

areas faintly perceptible or not at all; four longitudinal rows of large granule-bedecked tubercles present, three tubercles in each row except on the anterior segments, the third tubercle in each row broader and less distinct than the others and occupying a small lobe of the posterior margin; front margin of each metazonite with an irregularly raised rim extending across the dorsum and half way or more across each keel; posterior end of body narrowing suddenly and with the large tubercles decreasing in size; keels of segment 19 considerably smaller than those of segment 18, with the last segment exposed in the sinus between them.

Anal valves moderately inflated, shining, almost smooth; raised margins thin.

Preanal scale triangular, with a setose conic tubercle rising from the surface on either side near the apex.

Third segment of the female with a high thin crest along the anterior margin behind the second legs.

Type. *M. granulatus* spec. nov.

#### MELANODESMUS GRANULATUS spec. nov.

A single female collected between 5,000 and 8,000 feet elevation, Loma Rucilla and mountains north, Cordillera Central, Dominican Republic, June 1938.

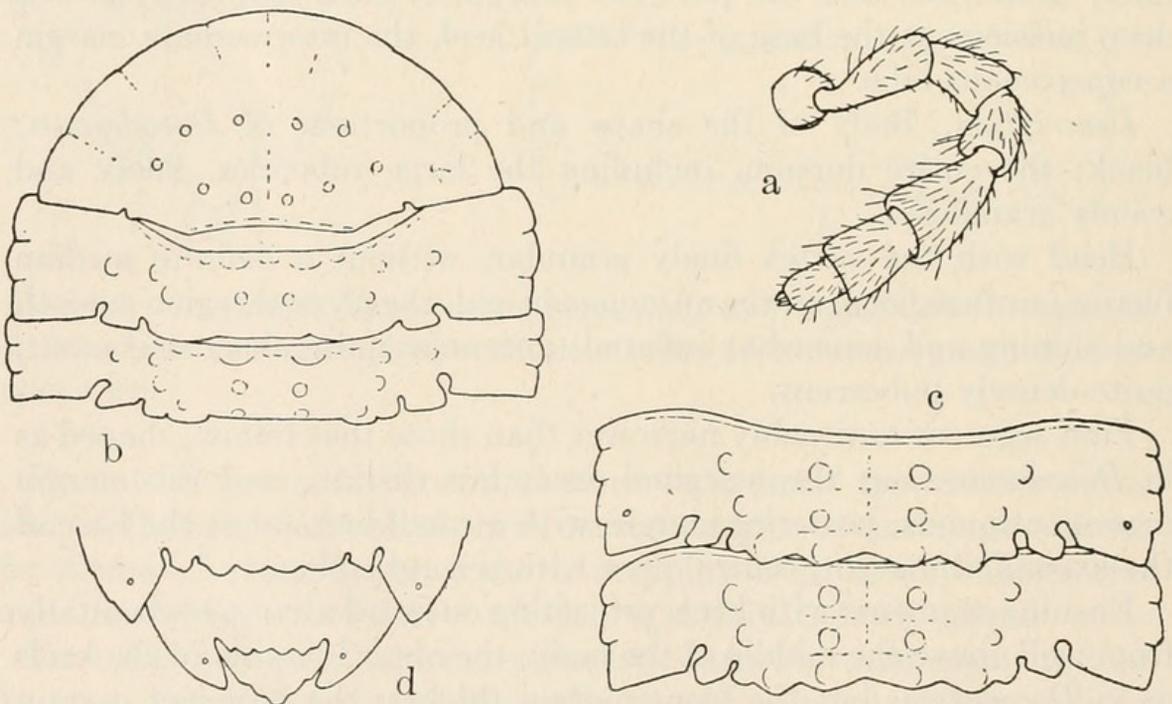


Fig. 30. *Melanodesmus granulatus*. a, Antenna; b, Segments 1 to 3, dorsal view; c, Segments 10 and 11, dorsal view; d, Segments 18 to 20 in outline, dorsal view.

Length 8.3 mm, width 2 mm; dorsum entirely dull black, the front of head, antennae, legs, sterna, hispid apex of last segment, anal valves and preanal scale white or colorless, remaining ventral surfaces black.

Head with hispid antennae as shown in figure 30, *a*, joints 6 and 7 together longer than either joint 2 or 5 which are subequal in length with the latter exceeding any of the other joints in width.

First segment distinctly narrower than segment 2 as seen in figure 30, *b*, almost semi-circular with the expanded front margin not appreciably scalloped, a few short indistinct lines giving faint indication of the usual quadrate areas; posterior margin with a small incision near the middle of each oblique section.

Segments 2 and 3 with dorsal tubercles as shown in figure 30, *b*, but on ensuing segments they are as shown in figure 30, *c*, except that on the caudal segments the tubercles decrease in size; the segments at the posterior end of the body shown in outline in figure 30, *d*.

Third segment of the female with the very thin ventral crest slightly higher at each side than at the middle.

#### IOMOIDES PARALLELA spec. nov.

Male type and two females from Sanchez and vicinity, Dominican Republic, July 1938.

*Diagnosis.* Similar to *I. glabra* Loomis in the hairless dorsum but differing in the larger size; greater development of the dorsal sculpture, with the four rows of tubercles parallel to each other; and in the form of the gonopods.

*Description.* Body longer and relatively broader than *I. glabra*, from 8.5 to 9 mm long and 2 to 2.2 mm wide, the dorsum without setae; all the tubercles larger and more prominent than in that species; color in alcohol black.

First segment with the anterior margin a little more rounded and scalloped than in the other species; disk with an anterior row of six tubercles, the outer one on each side very small, the next double its size and the inner one double the size of the second and much higher; in the posterior row of four tubercles the outer one is slightly smaller than the second tubercle of the first row, and the inner tubercle is as small or even smaller than the outer one of that row.

On ensuing segments the four rows of tubercles are strongly elevated, especially the two inner rows; all rows parallel instead of extending obliquely mesad from front to back; on segments 16 to 18, quite in contrast to the condition in *I. glabra*, the posterior tubercle

most developed and projecting caudad especially on segment 18; on segment 19 the anterior tubercle of each inner row is very small and hidden beneath the projecting tubercle of the preceding segment, second tubercle slightly larger, the last tubercle almost as large as that of the foregoing segment and projecting straight back contiguous to the last tubercle of the opposite row; segment 19 broader than in *I.*

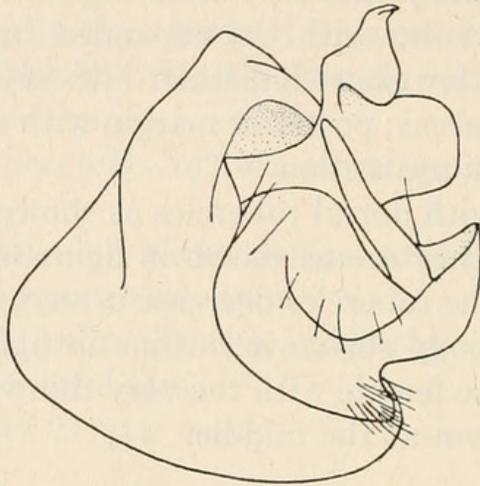


Fig. 31. *Iomoides parallela*. Left hand gonopod, mesoposterior view.

*glabra*, the posterior corner of the keels only slightly exceeded by the tips of the median tubercles; lateral keels of all segments definitely thicker than in *I. glabra*, the sinuses between the lobes of the anterior and posterior margins more open.

Gonopods as shown in figure 31.

Females with the ventral crest of segment 3 broader and lower than in *I. glabra*.

#### IOMOIDES CONJUNCTA spec. nov.

A single male collected at Villa Altagracia, Dominican Republic, July 1938.

*Diagnosis.* Intermediate between *I. hispida* Loomis and *I. parallela*, but lacking the long seta on each dorsal tubercle as in the former species and with much coarser dorsal sculpture; from *I. parallela* it differs in the hispidulous dorsum and the oblique rows of tubercles; the coalescence of the three tubercles in each inner row, forming simple crests on segments 2 to 5, does not occur in the other three species.

*Description.* Color black as in the other species; the body somewhat broader, being 8 mm long and 2.4 mm wide; the dorsal surface densely hispidulous but lacking the long seta on each tubercle as found in *I. hispida*.

First segment with the ten rectangular areas of the front margin long, especially the outer three on each side which are over twice as long as wide; inner surface strongly convex with an anterior row of six tubercles and a posterior row of four tubercles, the tubercle at each end of the front row and the inner pair of the back row are very minute; the second tubercle in the front row and the outer one in the back row are somewhat larger but less than half as large or as high as the inner pair of sharply conical tubercles of the front row.

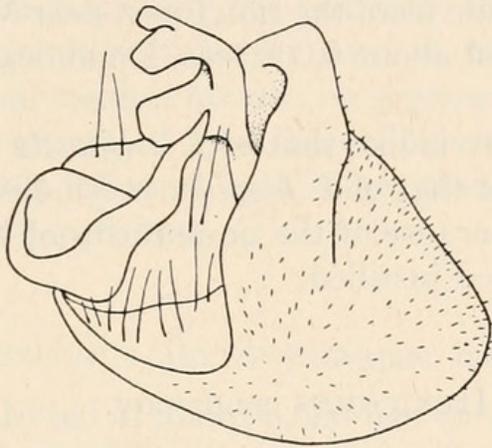


Fig. 32. *Iomoides conjuncta*. Right hand gonopod, mesoposterior view.

On segments 2 to 5 the tubercles of each inner row are coalesced and elevated into a simple ridge definitely higher than the corresponding rows of tubercles on mid-body segments, the two ridges on segment 2 are short but increase in length on succeeding segments; on segment 5 the individual tubercles composing each ridge are faintly evident and on segments 6 and 7 become more separated and thereafter are completely separated and lower; on segment 17 the last tubercle of each inner row is suddenly enlarged and produced backward far beyond the posterior margin; segment 18 with these tubercles almost as large and greatly produced but the two foregoing tubercles in each row are reduced to insignificance; from segment 2 to segment 18 the outer and inner rows of tubercles are oblique and converge caudally toward the median line, except those rows on the anterior segments which are developed into parallel crests; the tubercles of each outer row are of uniform size throughout the body, arranged in a curved oblique line, the middle tubercle farthest laterad, followed by the anterior one, with the posterior tubercle nearest the dorsum; segment 19 without dorsal tubercles except the posterior one of each median row, the two tubercles strongly projecting backward, touching along the inner side and to-

gether filling the sinus between the lateral keels, which they slightly exceed; on segments 2 to 19 each outer lobe of the lateral keels has a single seta in the margin slightly larger than those of the dorsal surface but smaller than the corresponding setae in *I. hispida*.

Gonopods as shown in figure 32.

Male with the second joint of legs 3 and 4 thicker than on the adjacent legs.

#### IOMOIDES sp.

A 19-segmented male from the rain forest near Valle Nuevo, Cordillera Central, elevation about 6,000 feet, Dominican Republic, August 1938.

The dorsal vestiture is like that of *I. conjuncta* although the sculpture, which resembles that of *I. hispida*, precludes its inclusion in the former species, but because of the immaturity of the specimen, a new name is not considered justified.

#### HENICOMUS genus nov.

*Diagnosis.* Outstanding feature of this genus is the pore formula which not only is unique in the family, where a normal formula is the rule, but it is not known to be duplicated elsewhere in the order Merocheta. The sequence of three- and four-lobed lateral keels is another curious and unique character. General form and sculpture suggest closest relationship with *Docodesmus* but the dorsum is more convex, with strongly descending lateral keels, and the anterior and posterior sterna of each segment are separately elevated.

*Description.* Body small, about six times as long as broad; dorsum strongly convex with lateral keels sharply descending to opposite the middle of the body or lower; sculpture resembling the type common in *Docodesmus* but not as distinct.

Head and antennae much as in *Docodesmus*.

First segment with the expanded front margin divided into 12 quadrate areas of which the outermost on each side is much narrower than any of the others; median area strongly convex, not divided into geometric areas but with ten tiny tubercles arranged as in *Docodesmus*.

Ensuing segments with faintly set-off quadrate areas each usually containing an indistinct tubercle; dorsum of these segments high and strongly convex, the lateral keels not projecting as far from the sides of the body as in *Docodesmus* and much more deflexed, the outer margin reaching opposite the middle of the body or below it; the outer

margin of segments 2, 3, 4, 5, 6, 8, 10, 11, 13, 14, and 16, three-lobed; the margin of segments 7, 9, 12 and 15 distinctly four-lobed; the margin of segments 17, 18 and 19 indistinctly and apparently indiscriminately three- or four-lobed; pores opening from the dorsal surface of the posterior lobe of the keels on segments 5; 10, 13, 16, 17, 18 and 19.

Last segment with two dorsal sub-median tubercles and a smaller one further forward near each side; apex slightly deflexed.

Anal valves but little convex, the thin margins only slightly raised; preanal scale rounded-triangular behind, with a large conic setiferous tubercle on either side surpassing the posterior margin.

Sterna definitely elevated, narrow, more so than in *Docodesmus*, and with a longitudinal median furrow; on segments having two pairs of legs the sterna are separated by a deep transverse channel.

Second legs of female followed by a raised transverse ridge.

Type. *H. septiporus* spec. nov.

#### HENICOMUS SEPTIPORUS spec. nov.

A single female collected at about 6,000 feet elevation, Loma Vieja, Cordillera Central, south of Constanza, Dominican Republic, August 1938.

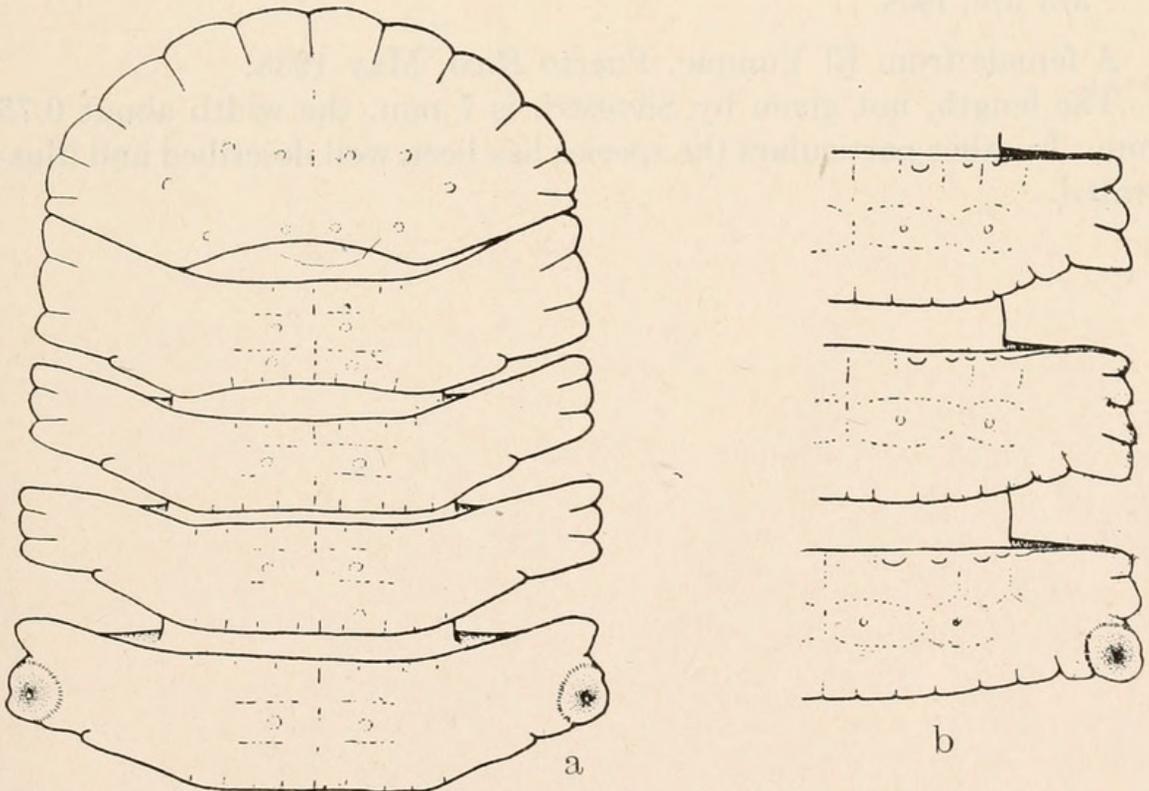


Fig. 33. *Henicomus septiporus*. a, Segments 1 to 5, dorsal view; b, Right hand half of segments 11 to 13, dorsal view.

Length 9 mm, width 1.5 mm; color in alcohol cinnamon brown. Segments 1 to 5 shown in figure 33, *a*, lateral carinae not projecting far enough to hide the distal half of the last joint of the legs; pores opening from the center of a broad, shallow, crater-like depression in a special swollen area which occupies the whole of the last lobe of the keel; on segments 5, 10, and 13 the lobe is rounded behind as shown in figure 33, *b*, but on segments 16 to 19 the lobes are produced backward into sharp angles, those of segment 19 not as long as on segment 18, widely separated, the last segment visible between them and extending a considerable distance beyond; segment 19 with six prominent scallops occupying the posterior margin between the poriferous keels; similar scallops, decreasing in size, are present on segments 18 and 17; figure 33, *b*, also shows nonporiferous three- and four-lobed keels.

Crest following the second legs of the female high, thin, and extending opposite the middle of the second joint of the leg on either side.

## COMODESMIDAE

### INODESMUS CARAIBICUS (Silvestri)

*Lasiodesmus caraibicus* Silvestri, Bull. Amer. Mus. Nat. Hist., Vol. 24, pp. 575-576, 1908.

A female from El Yunque, Puerto Rico, May 1938.

The length, not given by Silvestri, is 7 mm, the width about 0.75 mm. In other particulars the species has been well described and illustrated.



Loomis, H. F. 1941. "Millipeds collected in Puerto Rico and the Dominican Republic by Dr. P. J. Darlington in 1938." *Bulletin of the Museum of Comparative Zoology at Harvard College* 88, 17–80.

**View This Item Online:** <https://www.biodiversitylibrary.org/item/21129>

**Permalink:** <https://www.biodiversitylibrary.org/partpdf/6184>

**Holding Institution**

Harvard University, Museum of Comparative Zoology, Ernst Mayr Library

**Sponsored by**

Harvard University, Museum of Comparative Zoology, Ernst Mayr Library

**Copyright & Reuse**

Copyright Status: In copyright. Digitized with the permission of the rights holder.

License: <http://creativecommons.org/licenses/by-nc-sa/3.0/>

Rights: <https://biodiversitylibrary.org/permissions>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at <https://www.biodiversitylibrary.org>.