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New Genera and Species of North American Paraiulidae

By Ralph V. Chamberlin

This paper presents briefly some results of a preliminary taxonomic study of North American millipeds of the family Paraiulidae in the author's collection. It is based primarily upon a study of the male copulatory organs which offer the most convenient and dependable characters for the definitions both of the genera and of the species. Fuller accounts with discussion and illustrations of the females are deferred.

By this study the number of recognized genera in the family as represented north of Mexico is raised from 2 to 14, and the number of known species from 33 to 62. An additional new genus is also proposed for the Guatemalan species *Paraiulus leucoclius* Chamberlin.

Genus ANIULUS Chamberlin, new

The sternal plate produced forward from eighth segment in the male normally little developed, often obsolete, though the median part may extend as a narrow tongue-like process a variable distance between the bases of the posterior gonopods. Posterior gonopods consisting of a single seminiferous blade and a simple accessory blade arising at the base on the outer side. Coxal lobe of anterior gonopods a broad, simple, more or less leaf-like piece. (See figures.)

Exposed end of stipes of mandibles in male with distal corner produced distad or caudodistad.

Genotype.—*Aniulus adelphus*, new species.

In addition to the eight new species herein listed, this genus includes species of the *impressus* (Say) group, *robustior* Chamberlin, etc.

Aniulus adelphus Chamberlin, new species

Pl. I, figs. 1-3

Coloration much as in *craterus*, but a smaller form with fewer segments.

Exposed area of the stipes of the mandible in the male with the distocaudal corner produced much as in *craterus;* the oblique distal edge nearly straight. (See fig. 3.)

Collum in form and proportions nearly as in *craterus* but the anterior corners more widely convex. Second tergite not descending quite so low and with three sulci above lower end instead of two.

Anal tergite extended well beyond anal valves. Projecting portion straight or very slightly decurved at tip.

The gonopods in general most closely resembling those of *craterus*. Readily distinguished from the latter in the form of the freely exposed inner branch of the first gonopods. This is a broad plate the disto-caudal corner of which is produced ventrad and has its apex notched so as to present two small but distinct contiguous teeth and sometimes with additional denticles. The spur or basal branch of the posterior gonopods arises at the base on the outer side. (See figs. 1 and 2.)

Number of segments, 50 to 53.

Diameter of male holotype, 2.2 mm.

Locality.—Texas: Kendall Co., many specimens, in part taken 11 miles southwest of Boerne, all collected in December, 1939, by D. and S. Mulaik; also several taken in February-March, 1925, by P. H. Wright at San Antonio.

Aniulus austinensis Chamberlin, new species

Pl. I, figs. 4, 5

The stipes of the male mandible similar to that of *amophor* but the distal process bending but slightly caudad of directly distad.

Collum of male long, with only a margining sulcus present. Second tergite with two sulci on each side.

Anal scutum nearly as in *amophor*, the tip clearly exceeding the valves, straight.

Gonopods as illustrated. (Figs. 4 and 5.) The blades of posterior pair unusually broad.

Diameter of male, 2.5 mm.

Locality.—Texas: Austin.

Aniulus brazonus Chamberlin, new species

Pl. I, figs. 6-7

A prevailingly bluish form with brown annuli about caudal border of each segment. Legs reddish brown.

Stipes of mandibles of male as figures. (Fig. 6.)

Collum of male long, the lateral margin straight; with a single, margining sulcus. Second tergite on a level with collum; with two distinct sulci on each side.

Posterior angle of anal tergite acute, considerably exceeding the valves.

Posterior gonopods deeply seated, in situ vertical in position. See for details of both pairs the figures. (Figs. 7, 8.)

Diameter of male, 2.2 mm.

Locality.—Texas: Brazos Co., river bottoms. Mature males and females taken in December.

Aniulus craterus Chamberlin, new species

Pl. II, figs. 9, 10

A more robust species than *medicolens* distinguishable at once by its much lighter color which is typically light reddish but may vary to yellow. The usual dark spots along each side and under the lens showing a network of darker hairs over the light background. Vertex of head light, with the usual network of dark lines; the dark area between antennæ of usual form; lower part of head pale. Antennæ dark. Legs pale, with darker markings on distal joints.

Free end of stipes of mandible in male with distocaudal corner strongly produced, and curved a little caudad.

Collum in male longer than the second and third tergites taken together; lateral margin long, straight between the rectangular caudal corner and the rounded anterior corner; with the usual margining sulcus.

Second tergite with lower margin well below that of the collum, with two sulci on each side.

Last tergite acutely produced behind, the mucro exceeding anal valves considerably.

Outer lobe of anterior gonopods rather small, clavate, distally rounded, bearing about edge numerous long setae. The inner branch a decidedly broader, smooth chitinous blade of broadly clavate form and extending to a position caudad of the outer lobe. The posterior gonopods are vertically placed chitinous plates which are broad at base but narrow to a lamina curving cephaloventrad and attenuated to a slenderly acute tip through which the duct opens, also a spur caudad of this which is straight, acutely attenuated and of equal length with the curved branch. (Figs. 9, 10.)

Number of segments in male holotype, 61; in female allotype, 60.

Diameter of male holotype, 3 mm.

Locality.—Texas: Kerr Co., Raven Ranch. Many specimens, male and female, taken in December, 1939, by D. and S. Mulaik.

Aniulus dorophor Chamberlin, new species

Pl. II, figs. 11-13

A species related to *craterus*. It is at once distinguishable in the male by the form of the posterior division of the first gonopods; this is a chitinous lamina of a somewhat lanceolate outline with the attenuated apical portion much prolonged in a subcaudal direction and curved at the tip; the setose anterior division is of the usual clavate form. The main branch of the posterior gonopods is of the form usual in the group; the supplementary spur or branch is larger than the main branch and curves across its mate at the middle line. (Figs. 11-13.)

In the stipes of the male the distocaudal corner is broader and shorter than in *craterus* and *adelphus* with the caudal margin more convex.

The collum is of the form of that of *craterus*. The second tergite not descending below level of collum; with two sulci above lower margin.

The first legs of the male are of the form usual in the group, with the joints elongate, the fourth joint longer than the third. These legs curving up in front of head.

Anal scutum with obtuse point free, clearly exceeding the valves.

The color of this form is commonly light as in *adelphus* and *craterus*, but sometimes darker, more brown.

Number of segments in male holotype, 51, but the number may be as low as 47.

Diameter of male holotype, 1.8 mm.

Locality.—Texas: Live Oak Co., south of Three Rivers, many specimens taken in December, 1939, by D. and S. Mulaik.

Aniulus fluviatilis Chamberlin, new species

Pl. II, figs. 9, 10

A small form of which the male holotype consists of 52 somites.

The holotype is of a somewhat bluish cast marked with brown annuli.

Stipes much of the shape of that of *brazonus* but the distal process shorter and relatively thicker.

Collum relatively shorter than in *brazonus*, with the usual margining sulcus, and the second tergite with two sulci as usual in the genus.

Gonopods as illustrated. (Figs. 9, 10.)

Diameter of male holotype, 1.7 mm.

Locality.—Brazos Co., river bottoms. One male taken in December.

Aniulus oreines Chamberlin, new species

Pl. III, figs. 19, 20

Stipes of mandibles of male of nearly same form as that of *adelphus*.

Collum with only the margining sulcus Second tergite on each side with three sulci.

Anal tergite caudally rounded, not at all surpassing the valves.

Sternites of eighth segment in the male prolonged as a tongue-like process between the posterior gonopods and contacting sternite of seventh segment. Details of gonopods as illustrated. (Figs 19, 20.)

Number of segments 53.

Diameter of male, 2 mm.; of female, 2.5 mm.

Locality.—Colorado: 2 miles west of Glenwood. (R. V. Chamberlin, collector.)

Aniulus prosoicus Chamberlin, new species

Pl. II, fig. 16, and Pl. III, figs. 17, 18

A small, light colored species characterized in the male among other things by the form of the cardo of the mandibles and the details of the gonopods. The stipes as figured. (Fig. 16.)

Lower margin of the second tergite on a level with that of the collum; with three sulci above the lower margin.

Last tergite not at all or but very slightly surpassing the anal valves.

Outer setigerous lobe of first gonopods suberect, oblong, the sides parallel and the distal end rounded; inner, chitinous lobe also typically erect, broader and longer than the outer lobe, evenly rounded at the end. The principal blade of the posterior gonopods a curved blade somewhat uncate at the free end, the duct opening through the acute tip; supplementary blade slender, shorter than principal blade, below which it extends forward to the major subvertical curve in that blade. (See figs. 17 and 18.)

Number of segments in the male holotype, 50.

Diameter of male holotype, 1.8 mm.

Locality.—Texas: Edinburg. Three males and three females taken in 1938, by S. Mulaik.

Genus ORIULUS Chamberlin, new

The species of this genus are chestnut colored to nearly black, with the lighter annuli obscure or absent, the antennæ normally black. Posterior gonopods with principal branch bent ventrad beyond middle and then mesad so as to cross each other at middle line; accessory branch arising from base. Coxal lobe of first gonopod a more or less clavate lamina with at least distal portion of outer border rolled in mesad. Sternal plate from eighth segment large, triangular, covering well the bases of the posterior gonopods.

Genotype.—*Oriulus medianus*, new species.

Oriulus medianus Chamberlin, new species

Pl. III, figs. 21, 22

Dark brown, somewhat darker annuli near caudal margins of somites, but without distinct light annuli.

Stipes nearly of form of that figured for *adelphus*.

Collum of male with two sulci below on each side, the second with three of which the uppermost is short.

Anal scutum with posterior angle acute, surpassing the valves.

In the male the eighth sternite is produced forward in a triangular plate that overlaps the bases of the posterior gonopods. Posterior gonopods curving forward and then ventrad at level of femoral lobes of first gonopods, crossing each other at the median line. For details see the figures. (Figs. 21, 22.)

Diameter of male, 2 mm.

Locality.—Yellowstone Park: "Bear Dump," three specimens taken June 7, 1928; Montana; Utah: Emigration Canyon and Mill Creek Canyon, Salt Lake Co., and San Juan Co. at Devil's Canyon, La Sal Mts., etc.; Colorado; Iowa; Nebraska; New Mexico.

Oriulus delus Chamberlin, new species

Pl. IV, figs. 28, 29

Nearly related to *O. eutypus* but a smaller, less robust species distinct in the details of the gonopods.

A dark form in which the annulation is typically obscure as with other species of the genus.

The stipes of mandibles of male of typical general form.

Collum of male moderately elongate, with a second sulcus impressed only caudally above the margining sulcus. Second tergite with three sulci.

Gonopods notably smaller than those of *cutypus* when the two are placed side by side (accompanying figures not drawn to same scale). Lamina of coxal lobe of anterior gonopods relatively broader than in *eutypus*, less pointed apically. See further figs. 28 and 29.

Diameter of male, 2 mm.

Locality.—New York: Plattsburg; New Jersey; Virginia: Falls Church.

Oriulus eutypus Chamberlin, new species

Pl. III, figs. 23, 24

Apparently close to *O. delus* of New York but a somewhat larger form distinct in the larger size of the gonopods and in the details of their structure as shown in the figures. (Figs. 23, 24.)

Locality.—Minnesota: Minneapolis.

Oriulus notus Chamberlin, new species

Pl. 3, fig. 25, and Pl. IV, figs. 26, 27

Plate from 8th segment large, triangular, apex narrowly rounded, more acute than in the western *O. medianus*.

An unusually dark form from dusky chestnut to nearly black, apparently without definite lighter annuli. Antennae black, legs brown.

Stipes of mandible of male as shown in fig. 25.

Collum long, nower margin nearly straight, slightly incurved at middle; with two parrallel sulci just above margin on each side. Second tergite with three sulci.

Anal scutum ending in an acute mucro which exceeds the valves.

Anterior gonopods with coxal lobe relatively narrow, the sides nearly parallel except on the narrowest apical part. Posterior gonopods as drawn (see figs. 26 and 27.)

Diameter of female up to 2.5 mm.; less in the male.

Locality.—South Carolina: Gallatin River, near Taylor's Fork, June 14, 1929.

Oriulus georgicolens Chamberlin, new species

This species seems to be conspicuously different from the others here listed in having the lamina from the eighth somite in the male distally much broader and evenly convex, in this respect contrasting strongly, e.g., with *O. notus* of South Carolina.

The coxal lamina of the first gonopods strongly clavate to beyond middle and ditally narrowing subacutely, the caudal margin evenly convex. Femoral lobe of first gonopods slender, paralleling and contiguous with the anterior margin of the coxal piece. Posterior gonopods descending anteriorly beyond apices of anterior pair curving also backward and crossing at middle line in the usual manner; accessory branch running across diameter of the semicircle formed by the principal branch, the slender acute apex endng at the lower part of this branch.

Stipes of mandible with caudodistal corner produced in the usual way, the caudal margin moderately incurved.

Collum with the usual margining sulcus and a second sulcus just above it. Second tergite with three complete sulci on each side above lower margin.

Width of male, 2.2 mm.

Locality.—Georgia: Barrington. Four specimens taken October 13, 1932.

Genus *ETHOIULUS* Chamberlin

In the male the sternite of eighth segment produced forward as a triangular plate covering the bases of the posterior gonopods from below. Coxal lobe of anterior gonopods a relatively narrow blade curving from its base a little forward of mesad, its acute apex subcontiguous with its mate; typically with a large tooth one anterior side a little distad of middle. Main or seminiferous branch of the posterior gonopods a blade running forward and then coiled into a semicircle, the accessory branch arising on outside of base, presenting two prongs.

Genotype.—*Ethoiulus amphelictus* Chamberlin.

Ethoiulus amphelictus Chamberlin

Pl. IV, figs. 30, 31

Canadian Entomologist, 1918, pg. 361.

Locality.—Louisiana: Covington. Male holotype taken December 16, 1917.

Genus GOSIULUS Chamberlin, new

Distinct in the form of the gonopods of male. The posterior gonopods have present two long, slender branches each of which typically has a spine or spur as shown in the figures of *conformatus*. The inner lobe of the anterior gonopods elongate and relatively slender, with apex rounded and bearing typically several short retrorse processes as illustrated for the genotype.

Genotype.—*Gosiulus conformatus*, *new* species.

Gosiulus conformatus Chamberlin, new species

Pl. IV, figs. 32-35

The male with the free end of stipes of the mandibles of form shown in figure 32.

Gonopods of male as shown is Pl. 4, figs. 33-35.

The anal scutum has the caudal end obtusely angular, free at tip but not much surpassing the valves.

Number of segments in male holotype, 48.

Diameter, 1.8 mm.

Locality.—Texas: Live Oak Co., south of Three Rivers, one male; Big Springs, many males and females; McCulloch Co., south of Brady, several; Brooks Co., 17 miles north of Alice, several. All were taken in December, 1939, by D. and S. Mulaik.

Genus HAKIULUS Chamberlin, new

Outer lobe of anterior gonopods of more or less definitely clavate form; inner lobe prolonged distally into a relatively narrow lamina which curves first mesad toward middle line and then caudad in pointed tip. The posterior gonopods consist each of a comparatively broad blade lying in a subvertical plane and of general form illustrated for the genotype, and always with a characteristic subapical spine or spur; a conspicuous slender accessory branch arising from the outer side of the base of the principal blade. The known species have the anal tergite mucronate and the stipes of male mandibles with distocaudal angle conspicuously produced.

Genotype.—*Hakiulus amphor*, new species.

A genus at present known to occur chiefly in Texas and New Mexico but also reported in the Mississippi Valley as far north as Minnesota. The following species constitute the genus at present: *diversifrons* (Wood), *amophor*, new, *orthodox*, new, *parallelus*, new, *zakiwanus* Chamberlin, *neomexicanus* Chamberlin, *cyaneus* Chamberlin, and probably *ligifer* Chamberlin and *victorianus* Chamberlin.

Hakiulus amophor Chamberlin, new species

Pl. V, figs. 36-39

A generally light colored species, the body below level of the lateral dark spots usually especially light colored, pale yellow to whitish yellow; but the upper half of this light band is darker, brown when in full color, solid brown bars limiting this upper area below, areolation occurring above.

The stipes in the male as shown in fig. 39.

The collum in male nearly of general form of that in *Aniulus crateru*s. The second tergite extending a little below level of first and marked above lower edge with from four to six deep sulci.

Last tergite produced as in the preceding species.

Distinguished especially by the character of the gonopods which in general form suggest those of the New Mexican *zakiwanus* Chamberlin. The outer division of the first gonopods differs in having the expanded terminal plate less quadrate, more elongate as a narrowly oblong plate rounded at the free end. Very different in the details of the posterior gonopods; in these the principal blade below the acute, somewhat recurved apex bears a prominent erect and straight spine or spur; the supplementary process is slender and curves against and parallel with the caudal and upper, concave edge of the principal blade. (See pl. 5, figs. 36-38.)

Number of segments of male holotype, 53. Observed number in others, 48 to 53.

Diameter of male holotype, 2.8 mm.; of female allotype 3mm.

Locality.—Texas: Kerr Co., Turtle Creek, several mature males and females and many immature specimens; Live Oak Co., south of Three Rivers, many specimens; all taken in December, 1939, by D. and S. Mulaik.

Hakiulus orthodox Chamberlin, new species

Pl. V, fig. 40

In the male of this species the free end of stipes is shaped as in *amophor* but has the caudodistal angle even more produced and relatively more slender.

Anal tergite produced well beyond the anal valves in a moderately

slender acute mucro which curves slightly downward. The species is readily distinguished by the details of the gonopods. See figure 40.

Number of segments in male holotype, 51.

Diameter of holotype, 2.8 mm.

Locality.—Texas: College Station. Two males taken December 22, 1905.

Hakiulus parallelus Chamberlin, new species

Pl. V, figs. 41-43

Perhaps closest in structure to *H. orthodox*. The stipes of the male mandibles differs in lacking any production of the proximal angle as shown in figure.

The anterior gonopods are very similiar but the terminal portion more prolonged. Very distinct in the greater length and in details of form of the terminal portion of the posterior gonopods as shown in the figures.

Number of segments, 51.

Diameter, 2.2 mm.

Localities.—Oklahoma: Cleveland Co., April 5, 1929 (R. D. Bird, collector); Colorado: Fort Collins, two males taken October 15, 1894.

Genus SAIULUS Chamberlin, new

This genus is characterized by having the inner piece (coxa) of the anterior gonopods in the form of chitinous plates which meet in front in the middle line over the proximal half or so of their length so as to close the cavity containing the posterior gonopods which these coxal pieces may more or less sheath. The posterior gonopods bear a conspicuous accessory blade from base with the gonopods proper consisting of two columns fused except apically where one appears as a typically short stylus while the other is a broader membranous branch.

In the known species the mucro of the anal tergite is stout and conspicuously decurved or uncate.

Genotype.—*Saiulus setifer*, new species.

Includes also *S. canadensis* and *S. immaculatus*.

Saiulus setifer Chamberlin, new species

Pl. V, figs. 44, 45, and Pl. VI, figs. 46, 47

Readily distinguishable from *canadensis* and *immaculatus* in the structure of the gonopods of the male. In these the inner piece or coxa of the anterior pair is longer than the outer branch (femur) instead of being shorter. Very characteristic is the basal spur or blade of the posterior gonopods which is blade like and conspicuously setose along one margin as shown in the figure, such setae being absent in the other species. (See figs. 45-47.)

The free end of stipes of the mandible of the male only slightly incurved behind. (See Fig. 43.)

Locality.—Washington state: Puget Sound.

Genus ZINIULUS Chamberlin, new

Posterior gonopods fully exposed. Each of these is characterized by presenting two accessory branches which are slender and more or less similar to each other; the principal branch slender, distally acuminate.

Genotype.—*Ziniulus aethes*, new species.

Ziniulus aethes Chamberlin, new species

Pl. VI, figs. 48-50

Exposed area of stipes of the mandibles of male excavated posteriorly, both corners produced but the caudal much more so as shown in the figure. (Fig. 50.)

Posterior angle of last tergite acute, surpassing the valves.

The characteristics of the gonopods are shown by the figures (Figs. 48, 49).

Number of segments, 51.

Diameter of male holotype, 2 mm.

Locality.—Texas: Austin.

Ziniulus medicolens Chamberlin, new species

Pl. VI, figs. 51, 52

General color brown, commonly of more or less chestnut cast; on each ordinary segment two lighter areas above the dark spot at pore and two elongate ones below this level, each area reticulate with dark brown lines. Collum light brown entirely reticulate with lines of dark brown. Vertex of head dark brown with numerous small light spots. Antennae dark brown, distally nearly black. Last tergite and anal valves uniform brown. Legs brown, more or less marked with lighter spots.

Stipes of mandibles with exposed end rather deeply excavated on posterior edge, with distal corner extended caudad more than proximad much as in *aethes*.

Collum in the male and nearly equal in length to the two following tergites taken together; antero-lateral margin curving evenly from level of eye to ventro-caudal corner; with the usual margining sulcus but not otherwise impressed. Lower edge of second tergite on a level with that of the collum; with two deep striae above the lower margin.

Last tergite with caudal portion triangular, the median angle distinctly, though only moderately, surpassing the anal valves.

Outer branch of anterior gonopods a long and comparatively narrow plate which is slightly curved caudad, a little and gradually clavate above base with caudodistal corner acute and the anterodistal corner widely convex; outer face glabrous, the anterior and distal margin setose. Inner branch of anterior gonopod a rather slender blade curved inward toward free end with apical portion shaped somewhat like a bird's head with short acute beak; two somewhat retrorse spurs on outer side at beginning of curve and a small obtuse tooth on opposite or inner edge more proximad. Second or posterior gonopods as shown in figures. (See Figs. 51, 52.)

Number of segments in male holotype, 53; in female 51-57.

Length of male holotype, about 32 mm.; diameter, 2.3 mm.

Locality.—Texas: Kerr Co., Raven Ranch, many specimens; also 11 miles southwest of Boerne, December 1939, by D. and S. Mulaik.

Genus SPATHIULUS Chamberlin, new

In this genus the posterior gonopods are not at all sheathed by the coxal lobe of the anterior, which are simple. Posterior gonopods with two branches of which the seminiferous one is long, slender, and aciculate; the other branch springs from the base and is also slender and pointed. In front of the base of the posterior gonopods arise from the sternite two relatively broad blades which much surpass in length the lobes of the anterior pair.

Genotype.—*Spathiulus leptus*, new species.

Spathiulus leptus Chamberlin, new species

Pl. VI, figs. 53-55

Pale, immaculate, somewhat reddish yellow along lower part of sides and brown over dorsum between pore spots; legs clear yellow; head yellow except over occiput; antennae with articles dark at distal ends.

Exposed face of stipes of mandibles of male with distocaudal corner broadly produced, the proximal one but little so that posterior margin is not deeply incurved (see figs. 54, 55).

First legs proportionately very strongly thickened as shown in relation to the stipes in figure.

The collum with margining sulcus rising to level of eye; a single sulcus above this below. Second tergite extending forward below collum; with three sulci on each side.

Caudal end of last tergite not mucronate, surpassing anal valves.

Gonopods as illustrated. (Fig. 53)

Number of segments, 52.

A slender form in which the diameter of the male holotype is only about 1.75 mm.

Locality.—California: Yosemite Park. One male taken Aug. 11, 1931.

Genus PTYOIULUS Cook

This genus is closer to the Pacific Coast genera *Taiulus* and *Caliulus* than to other genera occurring in the east. The gonopods are similarly elongate and salient with the coxal piece of the first pair similarly rolled into a tube that contains the posterior gonopod. The latter differs conspicuously from those of the genera mentioned in not being furcate, but agrees in having no basal spur or accessory branch.

Ptyoiulus pennsylvanicus (Brandt)

Pl. VIII, figs. 71-73

Julus pennsylvanicus Brandt, Recueil, 1845, p. 85.

Ptyoiulus pennsylvanicus Cook, Ann. N. Y., Acad. Sci., 1895, vol. IX, p. 6.

Localities.—Pennsylvania, North Carolina, etc.

Genus CALIULUS Chamberlin, new

Gonopods of male large and salient. Inner (coxal) lobe of anterior pair rolled into a tube open along mesal side, something like an open pea-pod, which normally incloses the posterior gonopods. Posterior gonopods each furcate distally, the two branches slender, more or less, acicular as shown in figures of species described below.

Genotype.—*Caliulus pachysomus*, new species.

Includes *C. furcifer* (Harger) and the six new species herein described.

Caliulus pachysomus Chamberlin, new species

Pl. VI, fig. 56

Characterized by its large size, its thickness at first sight, suggesting a spiroboloid form. The color is dark, often essentially black but with a narrow light annulus on each somite contiguous with the segmental suture on its caudal side; also a transverse light band on each side of dorsum above level of pore.

Stipes of mandibles in male with the posterior angles more evenly produced than in *catalinae*, the excavation thereby appearing deeper.

The collum in the male moderate, with three sulci above the lower margin of which the uppermost becomes the anterior margining sulcus above level of the others and extends to level of eye. Lower margin of second tergite above that of collum, with five longitudinal sulci above it.

Pores well removed from the suture which is widely excurved opposite it.

Anal tergite caudally bluntly rounded, considerably exceeding the anal valves.

Gonopods of the usual general form. Details of posterior pair as shown in figure.

Number of segments, 56 and near that number.

Diameter up to 6 mm.

Locality.—California: Yosemite Park. Types collected by Wilton Ivie, August 11, 1931, under the bark of decaying pine logs.

Caliulus montanae Chamberlin, new species

Pl. VII, fig. 63

A rather dark form with the usual color pattern. A whitish oblong area on each side of each segment below middle of height; a line of confluent small light spots on each side of dorsum extending down to pore in front of suture and the usual narrow pale annulus back of the suture but this sharply marked only across dorsum between pores.

Stipes of mandibles of male nearly as figured for *catalinae*.

Collum with three sulci at each end, these rather close together, especially the two uppermost. Sulci on second tergite four on each side.

Anal tergite blunt behind, free for a short distance.

Clearly distinct in the form of the posterior gonopods as shown in figure. (Fig. 63.)

Number of segments, mostly 55.

Diameter of male, near 2 mm.; of female, up to 3 mm.

Type Locality.—Montana: Nimrod. August 13, 1929, taken by R. V. Chamberlin.

Other Locality.—Montana: Hell Gate River, near Clinton. Taken by R. V. Chamberlin August 13, 1929.

Caliulus pugetensis Chamberlin, new species

Pl. VII, figs. 61, 62

Brown, with the usual pattern of markings; a narrow pale annulus back of segmental suture and between this and light caudal border a broader annulus of solid, darker brown.

Stipes of mandibles of male as figured. (Fig. 61.)

Collum of male with two definite sulci on each side or with trace of a weaker, short third one between the first of these and the margin. Margin a little lower than that of the second tergite, the lower margin of the latter rising obliquely upward from in front caudad. Above lower margin of second tergite four sulci or with trace of a fifth below.

Caudal end of anal tergite rounded, free, clearly exceeding the valves. Distinct in the details of the second gonopods of the male. (See fig. 62.)

Number of segments, 53.

Diameter of male holotype, 2.75 mm.; of female allotype, 3.3 mm.

Locality.—Washington: Puget Sound. One male, the holotype, and two females.

Caliulus rhodogeus Chamberlin, new species

Pl. VII, fig. 60

The ground color brownish gray, in part nearly black, extremely mottled with irregularly confluent light areas especially on the sides and below, on each somite with a narrow pale annulus contiguous with the suture on its caudal side.

Stipes of mandibles of male with caudodistal angle smaller than in *catalinae*, a little exceeding the broader proximal one, the excavation somewhat deeper.

Collum of male with four supramarginal sulci of which the third curves upward as the margining sulcus above its level, the fourth ending well back of the anterior border. Lower margin of second tergite on a level with that of collum; with four supramarginal sulci.

Anal tergite caudally blunt, a little exceeding the valves.

Posterior gonopods as illustrated.

Number of segments in the male holotype about 52, the broken condition leaving a little uncertainty.

Diameter of holotoype, 2.5 mm.

Locality.—California: Redlands. One male taken November 5, 1927.

Caliulus catalinae Chamberlin, new species

Pl. VII, figs. 57, 58

General color gray to brown typically of a marked olivaceous cast, conspicuously annulated with darker brown rings, one annulus on each segment a little in front of caudal edge, the border itself paler with contiguous part of succeeding somite again dark brown.

In the male the stipes of the mandibles with distocaudal angle only moderately produced but obviously exceeding the proximal angle, the caudal side moderately excavated. (Fig. 58.)

The collum in the male but little elongate; a short submarginal sulcus on each side and immediately above this a deeper sulcus which comes along the anterior border to level of eye; a third, deep horizontal sulcus with slight convexity dorsad, this sulcus a little upturned at anterior end. Second tergite with lower edge on a level with that of collum; four striæ above this margin.

Anal scutum with caudal apex blunt, distinctly, but only moderately, exceeding the valves.

The gonopods of male of typical general structure, but apparently distinct in the details of the posterior pair as shown in figure. (Fig. 57.)

Number of segments near 53.

Diameter of types up to 3.5 mm.

Locality.—California: Catalina Island. Eleven specimens taken December 22, 1933, by Dr. David T. Jones.

Caliulus concolor Chamberlin, new species

Pl. VI, fig. 56a, and Pl. VII, fig. 59

Typically of a nearly uniform reddish brown, with the head and collum sometimes (female allotype) abruptly paler; not annulate, in this differing conspicuously in appearance from *furcifer*, etc.; with the usual series of dark spots along each side marking the position of the repugnatorial glands.

Stipes of male with free end conspicuously excavated behind, with the caudodistal process rounded at end as shown in the figure. (Fig. 59.)

Collum of male with only two sulci on each side, these sharply impressed and continuous anteriorly as the margining sulcus. Second tergite with lower margin on a level with that of collum; with fine sulci above this margin.

Anal tergite rounded behind, only a little free.

Posterior gonopods of male curved conspicuously caudad near base of the prongs; of form shown in the figure. (Fig. 56a.)

Number of segments in male holotype, 54; in female allotype, 52.

Diameter of male holotype, 2.5 mm.; of female allotype, 3.1 mm.

Locality.—California: Redlands. January 8, 1928, under log.

Genus TAIULUS Chamberlin

Closely allied to *Caliulus* but differing in the posterior gonopods. In these the outer branch is laminate instead of aciculiform and distinctly acute, and the inner is a slender spur in the genotype.

Genotype.—*Taiulus tiganus* (Chamberlin).

Taiulus tiganus (Chamberlin)

Paraiulus tiganus Chamberlin, Ann. Ent. Soc. America, 1910, vol. III, p. 254, pl. Xd, fig. 6-8, and pl. XLI, figs. 1-4.

Localities.—Utah; Idaho; Wyoming.

Genus SOPHIULUS Chamberlin, new

Contrasting with *Caliulus* in that the posterior gonopod on each side is partly sheathed by the outer or femoral lobe of the anterior pair whereas the inner or coxal piece is slender, elongate and not at all rolled. The posterior gonopod also differs decidedly in form as shown in the figure of *tivius*.

Genotype.—*Sophiulus tivius* (Chamberlin).

Sophiulus tivius (Chamberlin)

Pl. VII, fig. 64

Parajulus tivius Chamberlin, Ann. Ent. Soc. Am., 1912, vol. V, p. 163, pl. XI, figs. 1-7.

Localities.—California: Mill Valley (1911); Stanford (Dec. 29, 1927); San Francisco.

Genus LITIULUS Chamberlin, new

Gonopods elongate and salient as in *Caliulus*, etc. Characterized by the posterior pair which are erect and wtihout accessory branch or basal spur; inner side setose.

Genotype.—*Litiulus alaskanus* (Cook).

Litiulus alaskanus (Cook)

Paraiulus alaskanus Cook, Harriman Alaska Expedition, vol. VIII, part I, 1904, p. 70, plate V, figs. 4c-4k.

Localities.—Alaska: Metlakatla, Juneau, Sitka, Yakutat Bay, Forrester Id. (H. Heath, July, 1913) and Snettisham (E. Bergroth, Coll.). Washington: Chinook, Aug. 7, 1929 (R. V. Chamberlin).

Genus CODIULUS Chamberlin, new

Gonopods of male conspicuously salient as in *Caliulus*. The posterior gonopods furcate as in the latter genus but differing in having the seminiferous branch expanded at distal end into a characteristic, commonly cuneate, membranous piece instead of being more or less aciculate.

Genotype.—*Codiulus oulogon*, new species.

The genus includes, in addition to the genotype, *C. milpetanus*, new species, *C. hewitti* Chamberlin and *C. oregonensis* (Wood).

Codiulus oulogon Chamberlin, new species

Pl. VII, fig. 66

Dark brown above, much paler over lower parts of sides and ventrally. The usual narrow light annulus behind suture and a broader deeper brown annulus about posterior part of somite.

Caudodistal corner of free end of stipes in male much thicker and more produced than the proximal one.

Collum with only the single margining sulcus on each side, the second tergite with three.

Anal tergite with posterior angle acute, the mucro straight, exceeding the anal valves.

The posterior gonopods differing conspicuously from others in being freely exposed distally and in curving back proximad as shown in figure. (Fig. 66.)

Number of segments near 53.

Diameter, up to 4.2 mm.

Locality.—California: Riverside, "Box Springs grade." Taken under rocks after a rain by J. C. Chamberlin, Nov. 26, 1925.

Codiulus hewitti (Chamberlin)

Pl. VII, fig. 67, and Pl. VIII, figs. 67-69

Paraiulus hewitti Chamberlin, Canadian Entomologist, 1919, p. 119, fig. 21.

Localities.—British Columbia: Agassiz (Dr. C. Gordon Hewitt); Washington State: Rainier National Park, and in western part (R. V. Chamberlin).

Codiulus milpetanus Chamberlin, new species

Pl. VIII, fig. 70

Notably smaller than typical *oregonensis* and wholly lacking the chestnut cast common in the latter. Dorsum with dark areas of the typical color pattern black; sides below pore areas above with network of fine black lines and below a clear light yellowish.

Stipes of mandibles of male with exposed area deeply excavated behind with the distal corner much more strongly produced caudad than the proximal.

Collum of male at each end with two sulci of which the lowermost is weak, the second deep and curving up as the margining sulcus in front. Second tergite with three well-spaced sulci.

The gonopods of the male as shown in fig. 70.

Number of segments, 51 or 52.

Diameter of male holotype, 2 mm.

Locality.—California: Milpetas. Feb. 1, 1928. (J. C. Chamberlin.)

Genus SIMIULUS Chamberlin, new

Set apart by distinctive characters in the gonopods of the male of which the most obvious feature is the greatly enlarged coxal division of the anterior pair. The two coxal divisions meet along their mesal edges so as completely to close the gonopodal cavity and to cover the posterior gonopods from in front and below.

Genotype.—*Simiulus arius* (Chamberlin).

Simiulus arius (Chamberlin)

Pl. VII, fig. 65

Parajulus arius Chamberlin, Pomona College Jour. of Ent. and Zoology, 1918, vol. X, no. 1, p. 10.

Locality.—California: Stanford.

Genus THRINIULUS Chamberlin, new

The coxal pieces of the anterior gonopods broad plates proximally contiguous with each other at the middle line and nearly closing the gonopodal cavity in front. The main division of the posterior gonopods with two deeply and widely separated prongs; with two relatively simple accessory branches arising on anterior side of base.

Genotype.—*Thriniulus leucoclius* (Chamberlin).

Thriniulus leucoclius (Chamberlin)

Paraiulus leucoclius Chamberlin, Proc. U. S. Nat. Mus., vol. 60, art. 8, p. 19, pl. 9, figs. 2-8.

Locality.—Guatemala: Actele; Tectic, Santa Rosa.

Figures and Explanations

Plate I

Aniulus adelphus, new species

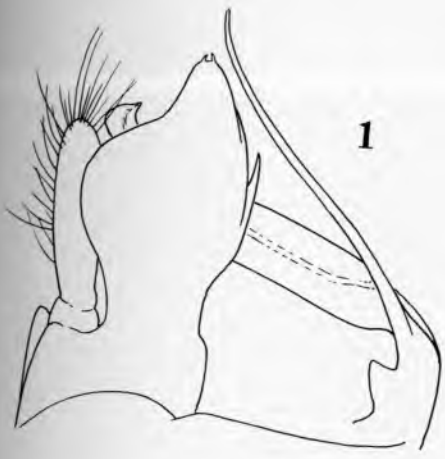
3. Lateral view of stipes of mandible, left side.
2. Right gonopods, caudal view.
1. Right gonopods, ectal view.

Aniulus austinensis, new species

4. Right anterior gonopod, ectal side.
5. Left posterior gonopod, mesal side.

Aniulus brazonus, new species

6. Stipes of right mandible, ectal view.
7. Right anterior gonopod, ectal view.
8. Left posterior gonopod, ectal view.



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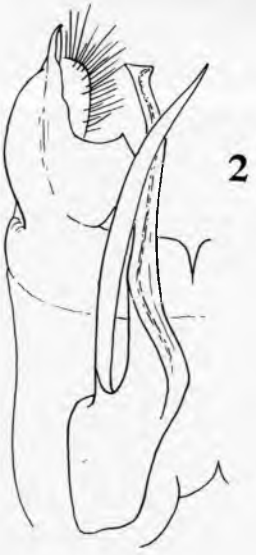

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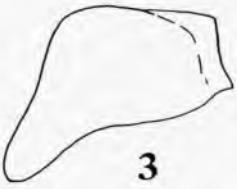

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Plate II

Aniulus craterus, new species

9. Left anterior gonopod, ectal side.
10. Left posterior gonopod, ectal side.

Aniulus dorophor, new species

11. Right anterior gonopod, ectal side.
12. Right anterior gonopod, caudal aspect.
13. Right posterior gonopod, mesal aspect.

Aniulus fluviatilis, new species

14. Left anterior gonopod, ectal aspect.
15. Right posterior gonopod, subventral aspect.

Aniulus prosoicus, new species

16. Stipes of left mandible, ectal aspect.

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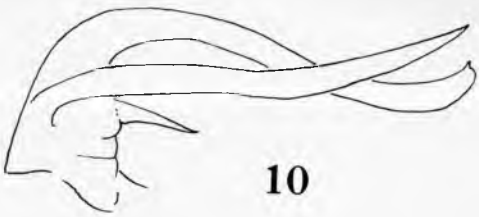

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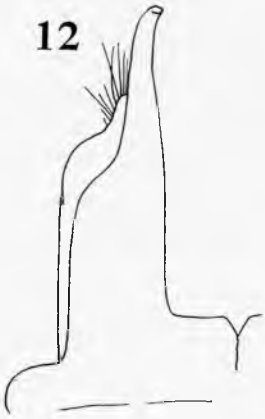

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Plate III

Aniulus prosoicus, new species

17. Left anterior gonopod, ectal view.
18. Right posterior gonopod, ectal view.

Aniulus oreines, new species

19. Left anterior gonopods, ectal view.
20. Left posterior gonopod, ectal view.

Oriulus medianus, new species

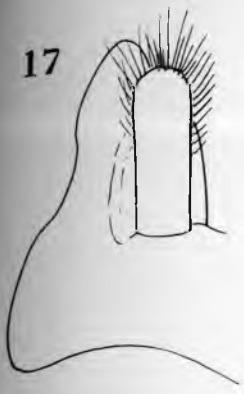
21. Right anterior gonopod, ectal view.
22. Left posterior gonopod, anteroventral view.

Oriulus eutypus, new species

23. Right anterior gonopod, ectal view.
24. Right posterior gonopod, subectal view.

Oriulus notus, new spicies

25. Stipes, etc., of left mandible, ectal view.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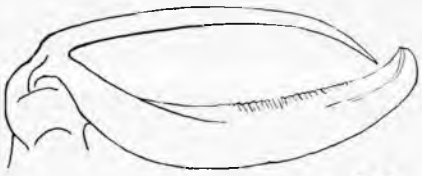
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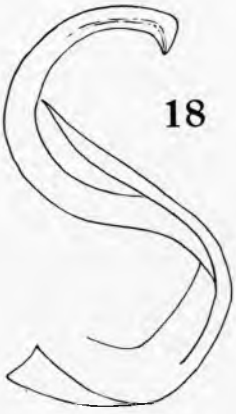
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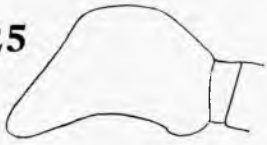
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Plate IV

Oriulus notus, new species

26. Right posterior gonopod, anteroventral aspect.
27. Right anterior gonopod, ectal aspect.

Oriulus delus, new species

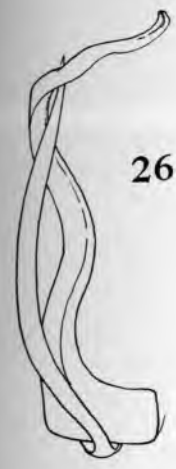
28. Right posterior gonopod, anteroventral aspect.
29. Left anterior gonopod, ectal aspect.

Ethoiulus amphelictus (Chamberlin)

30. Left anterior gonopod, ectal view.
31. Left gonopods, ectal aspect.

Gosiulus conformatus, new species

32. Stipes of left side, ectal aspect.
33. Right anterior gonopod, caudal aspect.
34. Right posterior gonopod, ventrocaudal view.
35. Portion of right posterior gonopod, another specimen, with apices of processes broken off, in a little different view.



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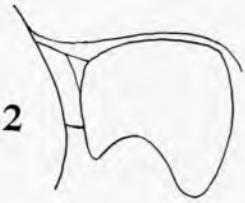

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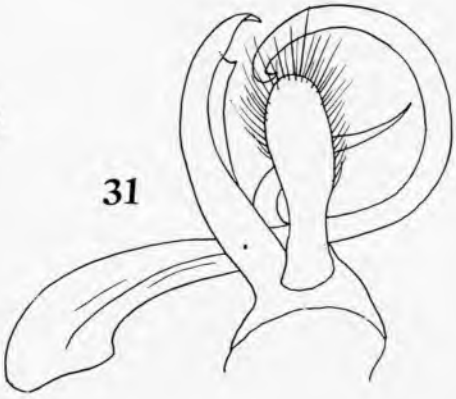

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Plate V

Hakiulus amophor, new species

36. Gonopods of right side in situ, ectal aspect.
37. Right anterior gonopod, ectal aspect.
38. Right posterior gonopod, ectal aspect.
39. Stipes, right side, ectal aspect.

Hakiulus orthodox, new species

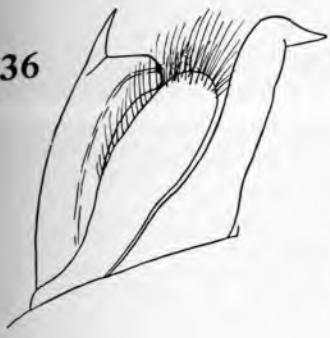
40. Right gonopods, ectal aspect (proximal portion of posterior gonopod omitted).

Hakiulus parallelus, new species

41. Right gonopods, ectal aspect.
42. Right posterior gonopod, ectal aspect.
43. Stipes of right side, ectal aspect.

Saiulus setifer, new species

44. Right stipes and first leg, ectal aspect.
45. Posterior gonopod, ectocaudal view, accessory branch not shown.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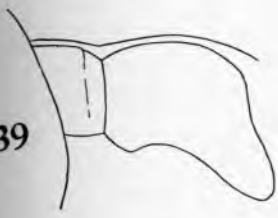
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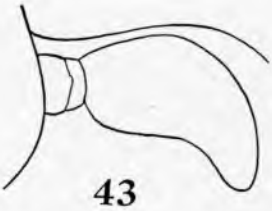
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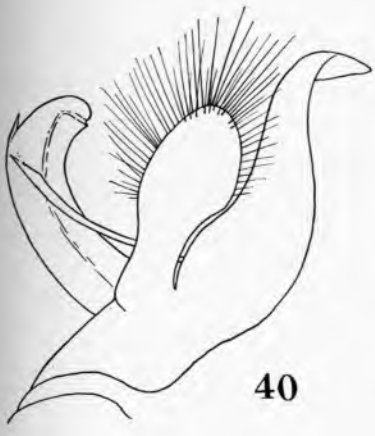
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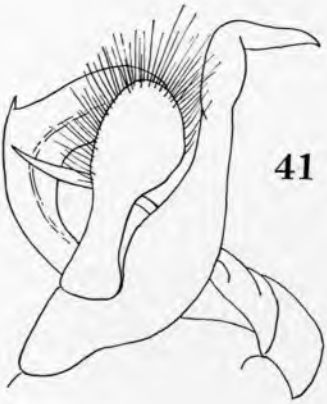
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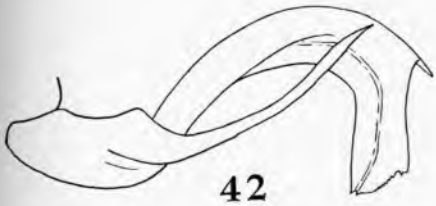
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Plate VI

Saiulus setifer, new species

46. Gonopods, anterior view.
47. Posterior gonopod, ectal view.

Ziniulus aethes, new species

48. Gonopods, anterior aspect.
49. Right anterior gonopod, ectal aspect.
50. Stipes of right side, ectal aspect.

Ziniulus medicolens, new species

51. Left anterior gonopods, ectal aspect.
52. Distal portion of left posterior gonopod, anteroventral aspect.

Spathiulus leptus, new species

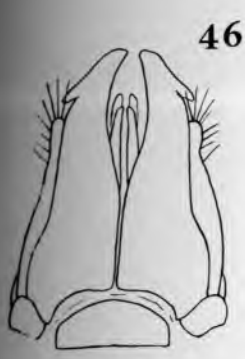
53. Gonopods, caudal aspect.
54. Right stipes and first leg, ectal aspect.
55. Left stipes, ectal aspect.

Caliulus pachysomus, new species

56. Right posterior gonopod.

Caliulus concolor, new species

56. Left gonopods, ectal view.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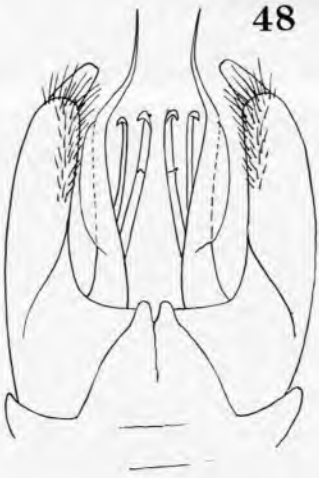
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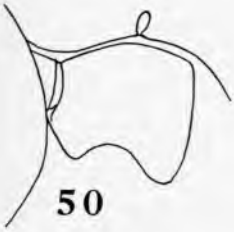
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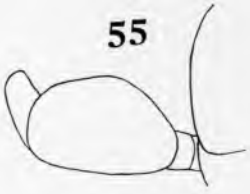
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Plate VII

Caliulus catalinae, new species

57. Left posterior gonopod.
58. Stipes of right side, ectal aspect.

Caliulus concolor, new species

59. Stipes of right side, ectal view.

Caliulus rhodogeus, new species

60. Right posterior gonopod, ectal aspect.

Caliulus pugetensis, new species

61. Left stipes, ectal view.
62. Left posterior gonopod, caudal view.

Caliulus montanae, new species

63. Right posterior gonopod, distal portion, caudal view.

Sophiulus tivius (Chamberlin)

64. Right posterior gonopod.

Simiulus arius (Chamberlin)

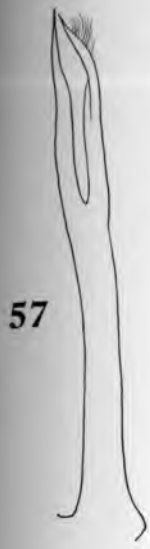
65. Left anterior gonopod in situ, ectal aspect.

Codiulus oulogon, new species

66. Gonopods, caudal view.

Codiulus hewitti (Chamberlin)

67. Gonopods, subanterior view.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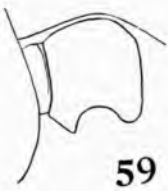
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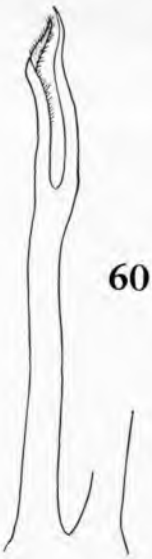
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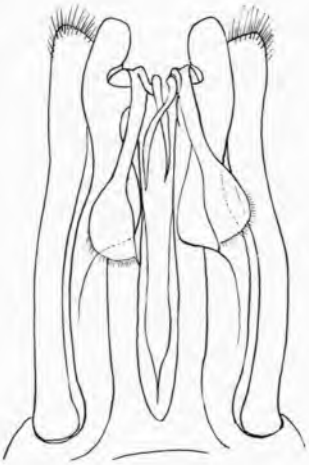
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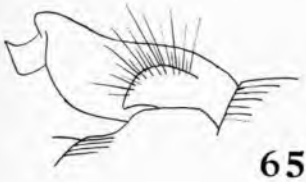
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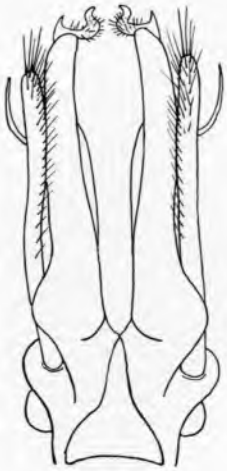
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Plate VIII

Codiulus hewitti (Chamberlin)

67. Caudal view of right posterior gonopod in place in sheath formed by coxa of first gonopod.
68. The same, second specimen. (Rainier National Park.)
69. Caudal view of left posterior gonopod.

Codiulus milpetanus, new species

70. Gonopods, posterior view.

Ptyoiulus pennsylvanicus (Brandt)

71. Right stipes, ectal view.
72. Posterior gonopod, lateral aspect.
73. Right anterior gonopod, caudal aspect.

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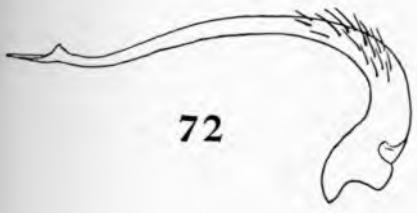

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