

NEW GENERA AND SPECIES OF PAUROPODA FROM CALIFORNIA

BY J. W. MACSWAIN AND U. N. LANHAM

University of California, Berkeley

The six new species of pauropods described herein are placed in two families, Brachypauropodidae and Eurypauropodidae, which have not previously been recorded from western North America. Each family is represented by a single species in the eastern United States.

On the basis of differences in rate of locomotion, Latzel (1883, 1884) divided the pauropods into "Pauropoda agilia" and "Pauropoda tardigrada," the former including the family Pauropodidae and the latter the families Brachypauropodidae and Eurypauropodidae. This distinction has not been retained as the primary division in modern classifications (e. g. Bagnall, 1935), but provides a convenient field character to distinguish the active, centipede-like Pauropodidae from the very slow-moving Brachypauropodidae. The pillbug-like Eurypauropodidae are moderately slow-moving forms. The Pauropodidae is the dominant family of the class from the standpoint of number of species, since it contains 90 percent (115 species and subspecies) of the described species. Of the 28 species of pauropods previously known from North America, 26 belonged to this family. The Brachypauropodidae contains five species, the Eurypauropodidae 12 species in the world fauna. The three remaining families, none of which has been recorded from North America, contain a total of nine species.

The definition of the class Pauropoda must be extended to include forms with only eight pairs of legs in the adult stage, since the three new genera described here are all believed to possess this characteristic. Pauropods have previously been characterized as possessing nine, or rarely ten pairs of legs.

Specimens were collected in the field by searching twigs or fallen logs, especially where leaf mold had accumulated, with the aid of a hand lens. It was found that Berlese-funnel extraction of litter gathered indiscriminately did not give good results in collecting the "Pauropoda tardigrada." Exceptionally favorable bits

of wood, which often harbored colonies of scores of individuals, were brought into the laboratory for further examination under a binocular microscope, since adults of some species are quite small, not exceeding 0.6 mm. in length. A thousand or more individuals of the families Brachypauropodidae and Eurypauropodidae were collected in four days of field work by these methods. Three localities in the San Francisco Bay area furnished most of the specimens: a small canyon in the Black Hills (about 1000 feet elevation), on the south slopes of Mt. Diablo, Contra Costa County, about two miles above the south entrance checking station of the Mt. Diablo State Park; Woolsey Canyon, a short distance north of the campus of the University of California, Berkeley; and numerous small canyons between Fairfax and Alpine Lake (three miles west of Fairfax) in Marin County. A single specimen of *Gravieripus* was collected from under redwoods in the Redwood Regional Park, near Oakland.

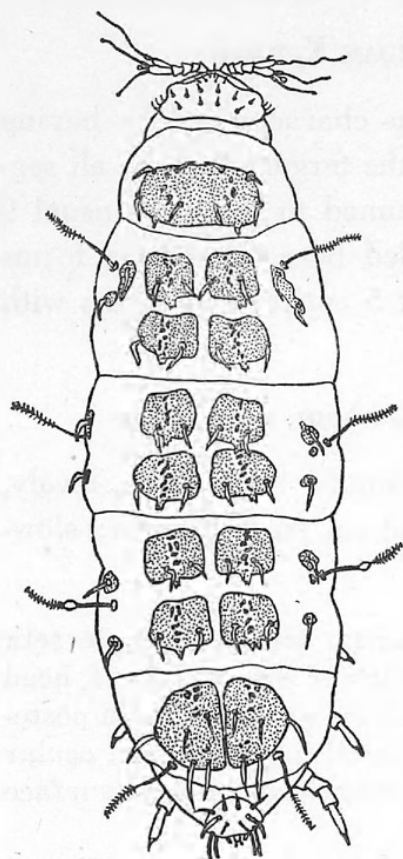
A good introduction to the literature may be found in the work of Starling (1943), in which is presented a bibliographic list of the species of Pauropoda of the world. More recent publications of general interest are furnished by Starling (1944) and by Tiegs (1947).

All material studied was cleared in KOH, stained lightly with acid fuchsin in acetic acid, washed in absolute alcohol, then transferred to clove oil and mounted on microscope slides in balsam.

The following descriptions are based mainly on the holotypes, but the nature of the material has made it necessary to describe certain details from other male specimens in the type series. All measurements are made from specimens mounted on slides, which are somewhat expanded.

Paratypes of all the species have been deposited in the collections of the United States National Museum and the British Museum (Natural History).

Plate I: Fig. 1, *Zygopauropus hesperius*, dorsal view, holotype male x 140; 1a, ventral view, anal plate x 620; Fig. 2, *Aletopauropus lentus*, dorsal view, holotype male x 140; 2a, ventral view, anal plate x 620; Fig. 3, *Deltopauropus luteus*, dorsal view, holotype male x 140; 3a, ventral view, anal plate x 620; 3b, lateral view, male organ x 550; Fig. 4, *Deltopauropus magnus*, dorsal view, holotype male x 105; 4a, ventral view, anal plate x 620; 4 b, lateral view, male organ x 550; 4c, dorsal head seta x 620.



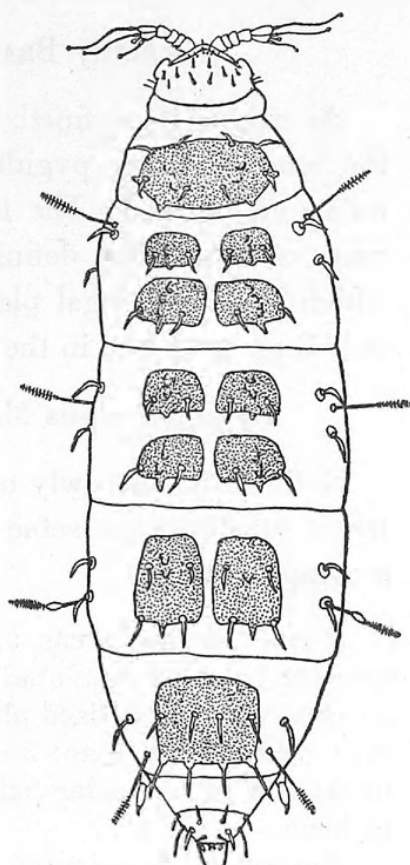
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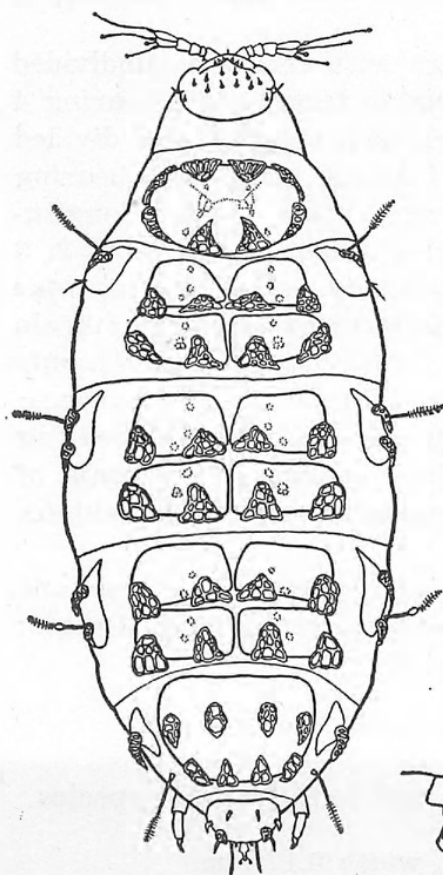
1a



2a



2



3



4c



3b



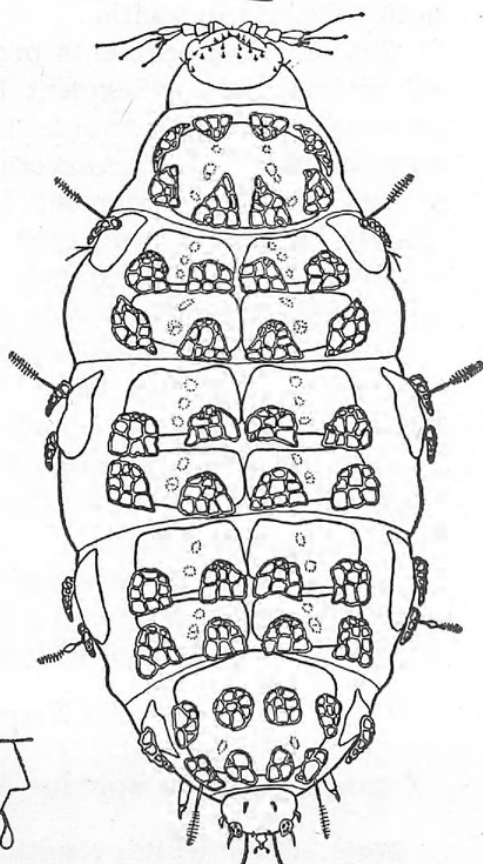
4b



3a



4a



4

Family BRACHYPAUROPIDAE Kenyon

As originally defined, this family was characterized by having the head, legs, and pygidium free, and the tergal plates of all segments subdivided. The family was assumed to have the usual 9 pairs of legs. The definition is extended here to include forms which have the tergal plates of segment 5 entire, and forms with only 8 pairs of legs in the adult stage.

Zygopauropus MacSwain and Lanham, new genus

Body form narrowly ovate; fresh specimens with loose, mealy, white substance on setae of dorsum and on trichobothria; slow-moving forms.

Head. Ocular areas appearing as lateral lobes; a single seta present between antennal insertions; anterior two-thirds of head covered with sclerotized plate bearing anterior group of 6 and posterior group of 10 setae; 3 slender lateral bristles behind each ocular area; row of 8 slender hairs on anterior margin of ventral surface of head.

Antennae. Scape with segment 2 conspicuously shorter than rest of segments; stylus latior slightly shorter than stylus angustior, both subequal in width.

Trunk. Five segments present; terga with entire or subdivided sclerotized plates. Segment 1 with a single tergal plate bearing 4 pairs of setae; segments 2, 3 and 4 each with tergal plates divided longitudinally and transversely into 4 parts, each part bearing a pair of setae; segment 5 with tergal plate divided longitudinally into two parts, each part bearing 5 setae. Segments 2, 3 and 4 with a pair of lateral setae on each side, corresponding setae on segment 5 represented by a single seta inserted on lateral margin of tergal plates. Setae bristle-like or slightly hastiform, strongly bent posteriorly near base. Four pairs of trichobothria present; those of segment 4 (third pair) strongly clavate, with club bearing apically a loosely plumose filament which is subequal to stalk of trichobothrium in length; those of segments 2, 3 and 5 filamentous, loosely plumose apically.

Legs. Eight pairs of legs present, all 5-segmented; coxa and trochanter each with a single annulated seta, tarsus with 3 setae; claw slender, pulvillus with a single bristle.

Type: *Zygopauropus hesperius* MacSwain and Lanham.

Zygopauropus hesperius MacSwain and Lanham, new species

Male. Color white; length 0.54 mm., width 0.17 mm.

Antennae. Stalk of globulus approximately one-third length of stylus latior, widened apically, posterior flagellum about two-thirds

length of anterior flagellum; stylus angustior widest near middle, its flagellum about one-fourth longer than anterior flagellum of stylus latior.

Trunk. Tergal plate of segment 1 with 2 longitudinal rows of irregular tuberosities, the last of each row appearing as large scales projecting beyond posterior margin of plate, tips of scales more or less jagged; tergal plates of segments 2-4 each with a similar row of tuberosities and posteriorly projecting scales; plates of segment 5 with tuberosities not so well developed and not extending beyond posterior margin. Tergal plates with ground sculpture of small, closely spaced, rounded tubercles. Lateral platelets usually subdivided into small sclerotized areas surrounding insertions of lateral setae, but occasionally platelets are entire. Trichobothrium of segment 2 inserted slightly before anterior lateral seta, trichobothria of segments 2 and 3 inserted lateral to and somewhat posterior to anterior lateral setae, trichobothrium of segment 5 inserted a considerable distance behind lateral seta. Penes constricted near middle, base broadened, apical portion subovoid, with subapical bristle.

Pygidium. Anal plate with basal portion expanded, stoutly clavate in outline, distal portions consisting of short, very strongly capitate hairs; sternum with posterior setae (b^1) moderately tapering, about 4 times as long as styli, anterior setae (b^3) slender, approximately equal in length to styli; styli rod-shaped, subequal to anal plate in length, tips rounded; tergum with row of 4 anterior, moderately strong setae (d , d^1 of Remy, 1936), lateral setae (a^3) half again as long as the thick, slightly sinuous intermediate setae (a^2), submedian setae (a^1) very slender, slightly longer than styli.

Female: Similar to male. Length 0.56 mm., width 0.20 mm.

Holotype, adult male (No. 5897, Calif. Acad. Sci., Ent.): South slopes of MT. DIABLO, CONTRA COSTA COUNTY, CALIFORNIA, 12 November 1947, under fallen oak branches (MacSwain and Lanham). *Allotype*, adult female (No. 5898, Calif. Acad. Sci., Ent.): same data as holotype. *Paratypes*: 1 adult male, 3 adult females, same data as holotype; 2 adult males, Fairfax, Marin County, California, 24 November 1947 (MacSwain and Lanham). Additional material includes 4 immature specimens with same data as holotype; one has 6 pairs of legs, two have 5, one has 3 pairs of legs.

Aletopauropus MacSwain and Lanham, new genus

Body form narrowly ovate; fresh specimens with loose, mealy, white substance on setae of dorsum and on trichobothria; slow-moving forms.

Head. Ocular areas appearing as distinct lateral lobes; single seta present between antennal insertions; anterior two-thirds of head covered with sclerotized plate bearing anterior group of 6 and posterior group of 10 setae; 1 pair of slender lateral bristles behind each ocular area; row of 8 slender hairs on anterior margin of ventral surface of head.

Antennae. Scape with segment 2 conspicuously shorter than rest; stylus latior subequal in length and width to stylus angustior.

Trunk. Five segments present; terga with entire or subdivided sclerotized plates. Segment 1 with tergal plate entire, with 4 pairs of setae; segments 2 and 3 with tergal plates divided into 4 parts, each part with 1 pair of setae; segment 4 with tergal plate divided longitudinally into two parts, each part with two pairs of setae; segment 5 with tergal plate entire, with 4 pairs of setae, the posterior row of setae inserted on posterior margin of plate. Segments 2-4 with 1 pair of lateral setae on each side; segment 5 with 1 lateral seta, which is distant from tergal plate. Setae bristle-shaped or slightly hastiform, abruptly bent posteriorly near base. Four pairs of trichobothria present; those of segment 4 (third pair) strongly clavate, with club bearing apically a plumose filament which is subequal to stalk of trichobothrium in length; those of segments 2, 3, and 5 filamentous, loosely plumose apically, subequal in length.

Legs. Eight pairs of legs present, all 5-segmented; coxa and trochanter each with a single annulated seta, tarsus with 3 setae; claw slender, pulvillus with a single bristle.

Type: *Aletopauropus lentus* MacSwain and Lanham.

Aletopauropus lentus MacSwain and Lanham, new species

Male: Color white; length 0.56 mm., width 0.18 mm.

Antennae. Stylus latior approximately half again as wide at tip as at base, tip asymmetrically rounded, posterior flagellum somewhat more than half as long as anterior flagellum, stalk of globulus approximately one-half length of stylus, widened apically; stylus angustior widest at distal one-third, its flagellum one-third again as long as anterior flagellum of stylus latior.

Trunk. Segment 1 with tergal plate sub-oval in outline, produced laterally into a small lobe. Tergal plates of segments 2 and 3 each with a median row of tuberosities, the last of each row forming a conspicuous, usually entire tooth on the posterior margin of each plate; tergal plate of segment 1 with 2 such rows and 2 teeth on posterior margin; plate of segment 5 with tuberosities very weakly developed, no teeth on posterior margin. Ground sculpture of tergal plates consisting of small, closely spaced, rounded tubercles. Trichobothrium of segment 2 arising alongside anterior lateral seta, of segment 3 between lateral setae, of segment 4 alongside posterior lateral seta. Penes constricted near middle, base broadened, apical portion subovoid in outline, with subapical bristle.

Pygidium. Anal plate with basal portion expanded, ovate in outline, distal portions consisting of short, very strongly capitate hairs; sternum with posterior setae (b^1) slender, approximately 4 times as long as styli, anterior setae (b^2) very slender, short, and inconspicuous; styli rod-shaped, subequal to anal plate in length, tips rounded; tergum with row of 4 slender anterior bristles (d , d^1 of Remy, 1936), lateral setae (a^2) slender, half again as long as the stout, slightly hastiform intermediate setae (a^1), submedian setae (a^1) slender.

Female: Similar to male; length 0.60 mm., width 0.20 mm.

Holotype, adult male (No. 5899, Calif. Acad. Sci., Ent.): WOOLSEY CANYON, BERKELEY, ALAMEDA COUNTY, CALIFORNIA, 21 November 1947 (MacSwain). *Allotype*, adult female (No. 5900, Calif. Acad. Sci., Ent.): same data as holotype. *Paratypes:* 3 adult females, same locality as holotype, 26 November 1947 (MacSwain); 1 adult male, 3 adult females, same data as holotype. Other material includes 3 immature specimens; two have 6 pairs of legs, one has 5 pairs; all with same data as holotype.

Deltopauropus MacSwain and Lanham, new genus

Body form oblong-ovate; fresh specimens without white, mealy, substance on dorsum of trunk, but adult females with a conspicuous transverse white band of compact mealy substance on posterior margin of head; slow-moving species.

Head. Ocular areas appearing as distinct lateral lobes; a single seta present between antennal insertions; anterior two-thirds of head covered with sclerotized plate bearing anterior group of 6 and posterior group of 10 setae, anterior setae mounted on large tubercles; 2 slender lateral bristles behind each ocular area; row of 8 slender hairs on lower anterior margin of head.

Antennae. Scape with segment 2 conspicuously shorter than rest; stylus latior distinctly shorter than stylus angustior.

Trunk. Five segments; terga with entire or subdivided sclerotized plates. Segment 1 with tergal plate entire, bearing 4 pairs of setae; segments 2-4 with plates narrowly divided longitudinally and transversely into 4 parts, each part bearing one pair of setae; segment 5 with plate entire, bearing 4 pairs of setae. Setae highly modified, consisting of flattened triangular, subtriangular, or almost circular scales having surface ornamented with conspicuous network of raised lines; anterior row of setae of dorsal plate of segment 1, and all lateral trunk setae inverted, with bases of triangles anterior; setae attached at their anterior ends, except for anterior row of plate on segment 1. Segment 1 without lateral setae; seg-

ment 2 with 1 lateral seta of modified type, and 1 biramous bristle; segments 3 and 4 with a pair of lateral setae on each side; segment 5 with a single lateral seta. Four pairs of trichobothria present; those of segment 4 (third pair) strongly clavate, with club bearing apically a plumose filament about equal to stalk of trichobothrium in length, total length somewhat less than that of other trichobothria; those of segments 2, 3, and 5 filamentous, loosely plumose apically, all subequal in length.

Legs. Eight pairs of legs present, all 5-segmented; coxa and trochanter each with an annulated seta, tarsus with 3 setae; claw slender, pulvilli apparently each with a single bristle.

Type: *Deltopauropus luteus* MacSwain and Lanham.

Deltopauropus luteus MacSwain and Lanham, new species

Male: *Color* yellowish-white; length 0.56 mm., width 0.24 mm.

Antennae. Stylus latior slightly wider than stylus angustior at tip, tip obtusely conical, approximately one-third again as wide as base; stalk of globulus approximately as long as diameter of globulus; stylus angustior widest near tip, its flagellum approximately one-fourth longer than anterior flagellum of stylus latior.

Trunk. Tergal plate of segment 1 suboval in outline. Tergal plates without ground sculpture, except for indistinct median row of translucent platelets. Lateral platelets (those which bear lateral setae) of segments 2-5 entire. Modified setae of tergal plates triangular to subtriangular. First pair of trichobothria inserted alongside anterior lateral setae of segment 2, second pair between lateral setae of segment 3, third pair alongside posterior lateral setae of segment 4, fourth pair a considerable distance behind lateral setae of segment 5. Penes slightly constricted near middle, base not much widened, apical portion subconical, bristle slightly subapical.

Pygidium. Anal plate with basal portion expanded, trilobed, distal portions consisting of short, very strongly capitate hairs; sternum with posterior setae (b^1) slender, about half again as long as process of anal plate; styli short, appearing as tubercles bearing short apical bristles; tergum with anterior pair of slender setae (d^1) and with 1 anterior lateral seta (d) of modified scale-type, on each side, lateral seta (a^s) slender, slightly longer than the modified, scale-type intermediate setae (a^2).

Female: Similar to male; length 0.50 mm., width 0.26 mm.

Holotype, adult male (No. 5893, Calif. Acad. Sci., Ent.): south slopes of MT. DIABLO, CONTRA COSTA COUNTY, CALIFORNIA, 12 November 1947, under fallen oak branches (MacSwain and Lanham). *Allotype*, adult female (No. 5894, Calif. Acad. Sci., Ent.): same data as holotype. *Paratypes*: 19 adult males, 64 adult females, same data as holotype; 3 adult females, Fairfax, Marin

County, California, 24 November 1947 (MacSwain and Lanham). Additional material includes immature stages, with same data as holotype, classified as follows: 11 with 6 pairs of legs, 10 with 5 pairs, 3 with 3 pairs of legs. Also, there are many individuals, both adult and immature, preserved in alcohol, from the Mt. Diablo and Fairfax localities.

***Deltopauropus magnus* MacSwain and Lanham, new species**

Male: Color yellowish-white; length 0.75 mm., width 0.34 mm.

Very similar to *D. luteus*, differing as follows: size larger, about one-third longer, and relatively wider, more robust; modified setae of dorsum relatively larger, most setae departing more from triangular shape, being more rounded, or even subquadrate; anterior margin of tergal plate of segment 1 and of segment 5 more convex; penes constricted near base, apical portion twice as long as wide, distal half conical.

Female: Similar to male; length 0.76 mm., width 0.32 mm.

Holotype, adult male (No. 5895, Calif. Acad. Sci., Ent.): WOOLSEY CANYON, BERKELEY, ALAMEDA COUNTY, CALIFORNIA, 21 November 1947 (MacSwain). *Allotype*, adult female (No. 5896, Calif. Acad. Sci., Ent.): same data as holotype. *Paratypes*: 4 adult males, 3 adult females, same data as holotype; 11 adult males, 8 adult females, same locality as holotype, 26 November 1947 (MacSwain). Additional material includes 22 immature specimens, all from Woolsey Canyon, 26 November 1947 (MacSwain); these are classified as follows: 9 specimens with 6 pairs of legs, 12 with 5 pairs, 1 with 3 pairs.

The three genera just described are compared with each other and with *Brachypauropus* Latzel in the following key.

KEY TO THE GENERA OF THE BRACHYPAUROPODIDAE
OF THE WORLD.

1. Segment 5 (which bears third pair of trichobothria) with 4 tergal plates. Apparently always with 9 pairs of legs and 5 pairs of trichobothria in adult stage.....*Brachypauropus*
- . Segment 5 with 1 or 2 tergal plates. Eight pairs of legs and 4 pairs of trichobothria in adult stage.....2
2. Segment 5 with 2 tergal plates; lateral setae of segment 5 incorporated into lateral margins of tergal plates.....*Zygopauropus*
- . Segment 5 with 1 tergal plate; lateral setae of segment 5 not incorporated into lateral margin of tergal plate, but lying some distance from it.....3

3. Setae of dorsum highly modified to form triangular or subtriangular scales with sculptured surface; tergum of segment 4 (which bears third, or modified, pair of trichobothria) with 4 plates *Deltopauropus*
- . Setae of dorsum bristle-shaped, or at most slightly hastiform; tergum of segment 4 with 2 plates..... *Aletopauropus*

The genera *Zygopauropus*, *Aletopauropus*, and *Deltopauropus* possess characters in common which sharply separate them from *Brachypauropus*, the only genus previously known in the family. These differences may be summarized as follows: only 5 trunk segments, 8 pairs of legs, 4 pairs of trichobothria; segment 5 with a single lateral seta; pygidium with an additional row of 4 anterior setae. However, this entire set of characters has been found in the last larval (16-legged) instar of *Brachypauropus tuberosus* Remy (1936:319). The possibility that all the specimens of the family Brachypauropodidae obtained for this study were immature must be considered. However, this possibility seems very remote in view of such considerations as the relatively large numbers of individuals obtained, the fact that all earlier instars were represented, that the male genitalia were well developed, and that normal 18-legged adult individuals of another family, the Eurypauropodidae, were collected at the same times and places. Unfortunately, the possession of male genitalia is no certain indication of maturity, since Hansen (1902:336) has stated that "In immature males with eight pairs of legs I have found the organs smaller and less developed than in the adults; in one species, *Paur. spinifer*, of which I only possess an immature male, the organs are as large as in adult males of several other species, nevertheless they are scarcely arrived to full development." In *Deltopauropus* the case for regarding the fourth stage (16-legged forms) as adults seems to be established with a high degree of certainty. First, several hundred individuals were examined without finding one with nine pairs of legs. Secondly, each large colony was divisible into smaller groups composed of two or more fully pigmented 16-legged individuals and several 6, 10, and 12-legged unpigmented individuals, suggesting family groups. Finally, the 16-legged individuals differed from all preceding stages in that they possessed either well developed male genitalia or a band of white powdery substance on the posterior border of the head; these two categories are assumed to be adult males and females, respectively.

The number of legs present in the adult stage of some Old World species may be open to question. The specimens upon which the description of the type species of the genus *Brachypauropus* was based, *B. hamiger* Latzel (1884), had only eight pairs of legs, which together with the fact that no male genitalia were observed on any specimens, led Latzel to believe that his specimens were immature. However, *B. tuberosus* Remy (1936) was described as having nine pairs of legs.

The last larval instar of *B. tuberosus* differs from the supposed adult stage of the three New World genera in the fact that the tergal plate of segment 5 is subdivided longitudinally and transversely into four parts, whereas it is entire or is divided longitudinally into two parts in the New World genera. Therefore, even if the genera described here are based on immature specimens, they are adequately distinct from *Brachypauropus*.

On the basis of the foregoing observations and the present incomplete knowledge of the family Brachypauropodidae the authors prefer to include the genera *Deltopauropus*, *Zygopauropus*, and *Aletopauropus* in this family rather than to consider them a separate group. It would appear that these three genera have evolved their common characters through the development of precocious sexual maturity in the fourth instar and consequent loss of the fifth. Variability in number of instars is not unknown in the class, since certain species of Pauropodidae which have ten pairs of legs also have one more than the normal number of instars.

Family EURYPAUROPODIDAE Ryder

This family is characterized by having the tergal plates broadly expanded, concealing the head, legs, and pygidium.

Eurypauropus californicus MacSwain and Lanham, new species

Male: Color dark chestnut brown. Length 1.20 mm., width 0.65 mm.

Head. Four setae present between antennal insertions.

Antennae. Scape 4-segmented, segment 2 shortest, segment 4 longest. Stylus latior slightly longer than last two segments of scape taken together, only slightly widened apically, anterior margin longer than posterior margin; stalk of globulus approximately one-half length of stylus, longer than unsegmented portion of either flagellum; stylus angustior conspicuously shorter than stylus latior, unsegmented portion of its flagellum approximately one-third length of stylus; stalk of secondary globulus, on segment 3 of scape, approximately one-fourth length of nearest seta, inserted adjacent to seta.

Trunk. Terga with large, setose, evenly spaced tubercles on background of more numerous, much smaller, non-setose tubercles, connected by indistinct lines; large tubercles forming serrate margins of terga, those of dorsum oval in outline, and with seta short, hardly twice length of longest diameter of tubercles; all setae bristle-shaped; large tubercles lacking on anterior one-third of terga 2-5, each tergum with 4 small clusters of non-setose tubercles of intermediate size. Tergum 1 distinctly narrower than 2, biconvex in outline, anterior margin more strongly curved, so that line joining ends of posterior margin lies two-thirds to three-fourths distance from anterior to posterior margin; tergum 2 with anteriorly projecting tooth just mesad of each anterior corner, near insertion of trichobothrium; lateral margin with approximately 20 setose tubercles; terga 3-5 with U-shaped lateral notches near insertions of trichobothria, which are slightly deeper than wide, those of tergum 6 shallower and wider; tergum 6 with posterior margin slightly concave, concave portion with 8 weakly setose tubercles. Trichobothrium of segment 4 distinctly but not strongly clavate, apparently glabrous, somewhat shorter than others; trichobothria of segments 2 and 3 filamentous, apical portions very fine and plumose, those of segments 5 and 6 filamentous, glabrous, all except those of fourth segment subequal in length.

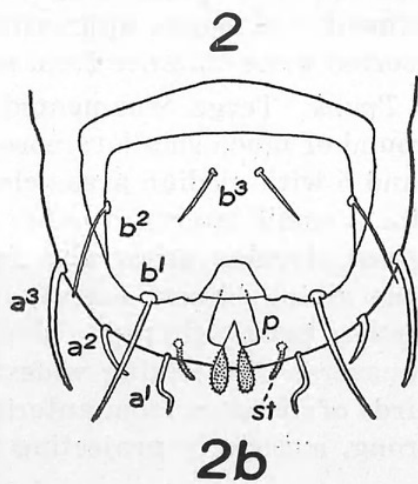
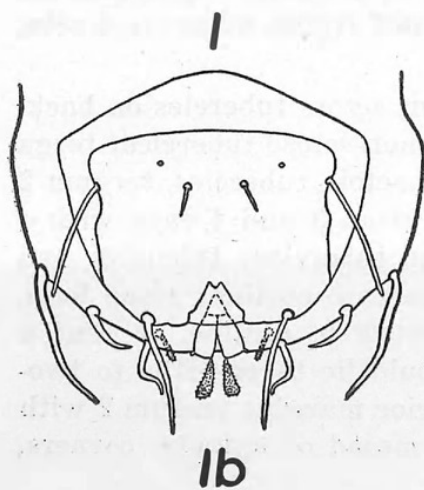
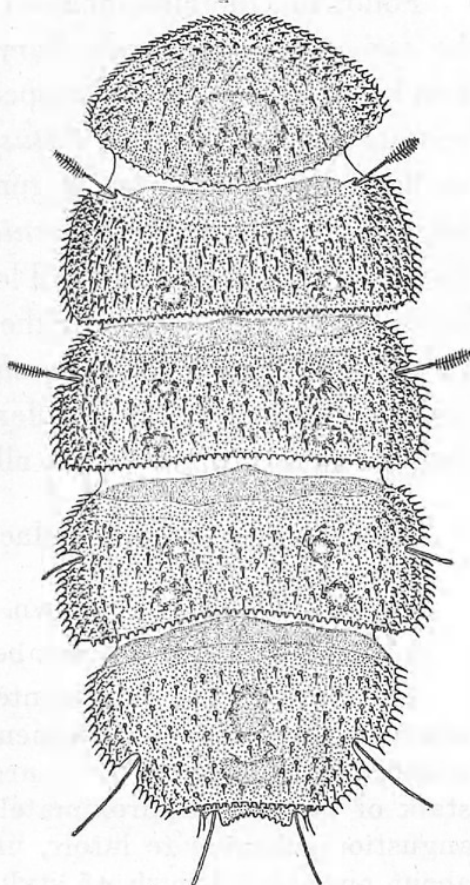
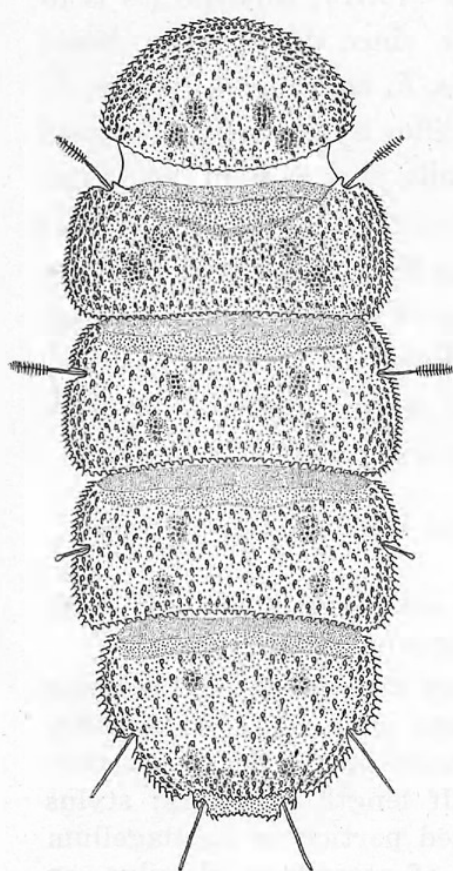
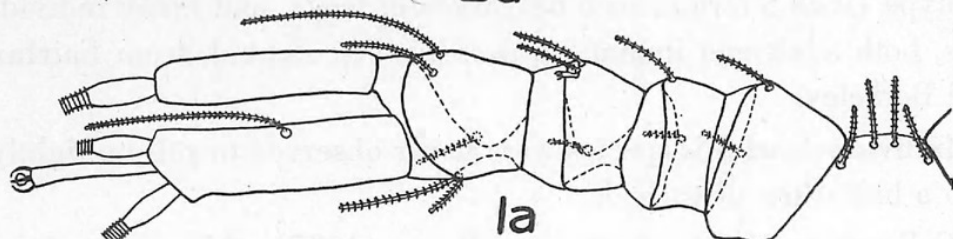
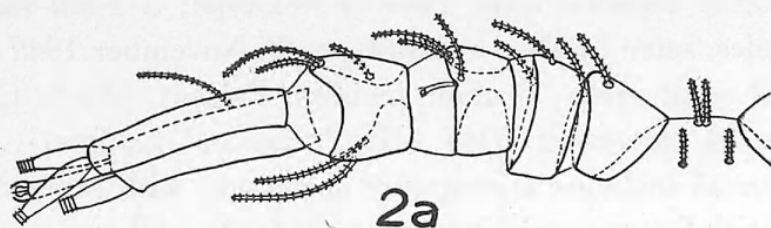
Legs. First and ninth pairs of legs 5-segmented, all others 6-segmented, the metatarsal suture being quite distinct; claw with two auxiliary bristles; trochanter with a single biramous hair, tibia and tarsus each with a short, simple seta on distal margin, metatarsus with two simple setae near apex, 5-segmented legs having tarsus with 3 setae.

Pygidium. Anal plate with basal portions separate, expanded, distal portions cuneate, tips widest, broadly rounded, lateral corners with a small process; sternum with posterior setae (b^1) slender, half again as long as anal plate, lateral setae (b^2) subequal to posterior setae, anterior setae (b^3) slender, short, inconspicuous; styli cylindrical, approximately one-half as long as a^2 , clavate; tergum with submedian setae (a^1) spirally crooked, slender, longer than a^2 , intermediate setae (a^2) moderately stout, approximately one-half length of lateral setae (a^3).

Female: Similar to male; length 1.44 mm., width 0.62 mm.

Holotype, adult male (No. 5891, Calif. Acad. Sci., Ent.): WOOLSEY CANYON, BERKELEY, ALAMEDA COUNTY, CALIFORNIA; 21 November 1947 (MacSwain). *Allotype*, adult female (No. 5892, Calif. Acad. Sci., Ent.): same data as holotype. *Paratypes*: 2 adult

Plate II: Fig. 1, *Eurypauropus californicus*, dorsal view, paratype male x 50; 1a, antenna x 350; 1b, ventral view, pygidium x 350; Fig. 2. *Gravieripus armatus*, dorsal view, holotype male x 50; 2a, antenna x 350; 2b, ventral view, pygidium x 350.



males, 4 adult females, same data as holotype; 3 adult males, 7 adult females, same locality as holotype, 26 November 1947 (MacSwain); 8 adult males, 9 adult females, Fairfax, Marin County, California, 24 November 1947 (MacSwain and Lanham). Additional material includes 4 immature specimens with same data as allotype (with 5 terga and 6 or 8 pairs of legs), and many individuals, both adult and immature, preserved in alcohol, from Fairfax and Berkeley.

Individuals of this species were never observed to roll up tightly into a ball when disturbed.

Following the classification of Remy (1937), this species is to be assigned to the genus *Eurypauropus*, since the pulvillus bears two bristles. The three European species, *E. consobrinus* Remy, *E. hastatus* Attens, and *E. ornatus* Latzel, differ by having leaf-shaped or flattened setae on the tergum, especially at the lateral margins; all tergal setae in *E. californicus* are bristle-shaped. *E. spinosus* Ryder, recorded from several localities in the eastern United States, lacks the strong tooth near the insertion of the trichobothrium on the second segment. *E. okinoshimensis* Esaki, of doubtful position, also lacks this tooth, and differs further in the outline of the sixth tergum, and in the fact that all legs are 5-segmented.

***Gravieripus armatus* MacSwain and Lanham, new species**

Male: Color pinkish brown. Length 1.46 mm., width 0.66 mm.

Head. Four setae present between antennal insertions.

Antennae. Scape 4-segmented, segment 2 shortest. Stylus latior about as long as last 2 segments of scape taken together, slightly widened apically, anterior margin distinctly longer than posterior, stalk of globulus approximately one-half length of stylus; stylus angustior subequal to latoir, unsegmented portion of its flagellum about one-third length of stylus; stalk of secondary globulus, on segment 3 of scape, approximately one-half length of nearest seta, inserted some distance from seta.

Trunk. Terga ornamented with larger, setose tubercles on background of much smaller, more numerous non-setose tubercles; terga 1 and 5 with median areas clear of large setose tubercles, tergum 2 with 2 small lateral circular areas and terga 3 and 4 each with 4 lateral circular areas also free of large tubercles; tubercles and setae giving lateral margins of terga serrate outline; setae long, slender, bristle-shaped. Tergum 1 biconvex in outline, so that a transverse line joining widest points would lie three-fifths to two-thirds of distance from anterior to posterior margin; tergum 2 with strong, anteriorly projecting tooth just mesad of anterior corners,

near insertion of trichobothrium; terga 3-6 each with a U-shaped lateral notch at insertions of trichobothria, which in terga 3-5 is usually slightly deeper than wide; tergum 5 with median hump approximately three-fourths distance towards posterior margin; tergum 6 less than half width of 5, projecting only slightly beyond 5, posterior margin strongly concave anteriorly, strong lateral notches lying close to concavity, two long setae just outside notches. Trichobothrium of segment 4 shorter and thicker than others, apparently glabrous throughout, apical third darkened by reason of inclusions, perhaps very slightly swollen; remaining trichobothria filamentous, those of segments 2 and 3 with apical third distinctly plumose; trichobothria of segments 2, 3 and 6 subequal, of segment 5 slightly longer than others.

Legs. All legs 5-segmented, (although tarsus occasionally has faint external creasing at the same point where metatarsal division occurs in those genera having 6-jointed legs): claw single, with two auxilliary bristles; trochanter with a single, two-branched hair, tibia with one and tarsus with three simple setae. Penes asymmetrical, conical, longer than wide, tips rounded, each with slender subapical seta.

Pygidium. Anal plate with basal portions distally separate, united near base, expanded, distal portions oblong-elliptical, widest near apices; sternum with posterior setae (b^1) slender, approximately twice as long as median process of anal plate, lateral setae (b^2) slightly longer than anterior setae (b^3). Styli cylindrical, about two-thirds length of a^2 ; tergum with submedian (a^1) spirally crooked, intermediate (a^2) and lateral (a^3) setae all slender, bristle-shaped, a^3 longer than a^1 , a^2 shorter than a^1 .

Female: Similar to male; length 1.4 mm., width 0.64 mm.

Holotype, adult male (No. 5889, Calif. Acad. Sci., Ent.): canyon on south slope of MT. DIABLO, CONTRA COSTA COUNTY, CALIFORNIA, 12 November 1947, under fallen oak branches (MacSwain and Lanham). *Allotype*, adult female (No. 5890, Calif. Acad. Sci., Ent.): same data as holotype. *Paratypes*: 4 adult males, 1 adult female, same data as holotype; 2 adult males, same locality, from litter under Toyon bush (*Photinia arbutifolia* Lindl.), 4 November 1947 (MacSwain). Additional material includes 13 immature specimens, with same data as holotype, and 1 immature specimen from litter under redwood trees, Redwood Regional Park, near Oakland, Alameda County, California, 2 November 1947 (Lanham). The immature specimens may be classified in respect to number of terga and pairs of legs as follows: 7 specimens with 5 terga, 8 pairs of legs; 3 specimens with 5 terga, 6 pairs; 2 specimens with 4 terga, 5 pairs; 3 specimens with 3 terga, 3 pairs of legs.

When disturbed, individuals of this species moved away, and were never observed to roll up tightly into a ball.

Following the classification of Remy (1937), this species falls in the genus *Gravieripus*, by reason of the 5-segmented legs and the antennal characters. *Gravieripus* previously contained only the single species, *G. latzeli* (Cook), of Europe, which is the *Eurypauropus spinosus* Ryder of Latzel (1884:34). *G. armatus* differs from *latzeli*, as figured by Remy (1937), in lacking leaf-shaped setae on the margin of tergum 4, in the non-clavate trichobothrium of segment 4, and in the expanded basal portion of the processes of the anal plate (linear in *latzeli*). Remy mentions no teeth near the anterior corners of tergum 2, a conspicuous feature of *armatus*. The Japanese *Eurypauropus okinoshimensis* Esaki (1934), of uncertain position in Remy's classification, but having all legs 5-segmented, also lacks the teeth of tergum 2, and has tergum 6 much larger than in *armatus*, and of different outline. The combination of characters such as teeth of tergum 2, the bristle-like setae on the terga (none strongly hastate or leaf-like) also separates *armatus* from the previously described species of *Eurypauropus*, as defined by Remy.

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