A New Genus and Species of Oribatei (Acari) Exhibiting External Sexual Dimorphism

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Although bisexuality is the rule in the Oribatei, the suborder is unique in the nearly complete absence of external structural characteristics differentiating males and females. Oudemans (1896) was the first to point out sexual differences in species of *Hydrozetes* Berlese, 1902, when he showed that in males of a species which he erroneously took to be *Hydrozetes confervae* (Schrank, 1781) there was a special seta of unusual form on tarsus I. Koenike (1911), apparently without knowledge of Oudemans' work, showed that in a species which he identified as *Hydrozetes lacustris* (Michael, 1882) the two sexes could be differentiated by the interval separating the genital and anal openings. In that species the genital and anal openings of the female are separated by a distance only about equal in length to the genital opening, while in the male this interval is considerably greater than the length of the genital opening. The present writer (1945) and Grandjean (1948, 1949) provided further information on external sexual dimorphism in *Hydrozetes*. Briefly, males in this genus can be distinguished from females either by the presence of a greatly enlarged seta on tarsus I or the interval between the anal and genital openings or both. It is also of interest that males in some species of the genus are exceedingly rare, sometimes comprising less than one per cent of a given population.

A less well-known case is found in *Galumna dorsalis* (Koch, 1836) (=*Zetes d.*). In his original description of that species, Koch pointed out that he had observed individuals in copula, and that one of the sexes had two posterior teeth on the hysterosoma and a sharp process between them. He did not, however, specify which sex was so characterized. Some later workers apparently missed Koch's observations, for male and female were actually described under different specific names. Thus *Oribates elimatus* Berlese is evidently the female of *Galumna dorsalis*, and *Galumna* (*Centroribates*) *mucronata* (G. and R. Canestrini) is probably the male (Grandjean 1935, p. 244). Moreover, Berlese (1914, p. 122, pl. 1, fig. 8) established the subgenus

[1] The drawings in this paper were prepared by Mari Riess of the University of California at Riverside. The scales are marked off in 10 μ units. This study was supported by a research grant from the University of California at Riverside.

Centroribates for the male of *Galumna dorsalis* Koch (=*Oribates mucronatus* G. and R. Canestrini). Further details of the nomenclatorial difficulties stemming from this may be found in papers by Grandjean (1935) and Vitzthum (1940, page 447). *Galumna uropygium* (Grandjean, 1928), originally described as *Centroribates uropygium*, is evidently distinct from *G. Dorsalis* (Koch). This species also exhibits sexual dimorphism.

Thus at present we have only one genus of Oribatei in which external sexual dimorphism is the rule, and a second one containing exceptional species in which the sexes can be differentiated by readily apparent external structures. Therefore it is of considerable interest to find a species in the Hawaiian fauna in which the males and females can be easily separated on the basis of external structure. This species does not appear to belong in any of the presently described genera, and it is made the type of a new genus, *Anisochthodes*.

Anisochthodes, new genus

Propodosoma and hysterosoma separated by only a feeble transverse line. Sensilla capitate, parasensillar setae absent. Pteromorphae absent. Epimeral areas I, II, and III clearly delimited, IV open posteriorly. A pair of setae immediately anterior to the genital opening, separated from each other by a distance little or no greater than the diameter of an alveolus. Genital sclerites with four pairs of setae, two at the anterior end and two at the posterior end; three pairs of genital acetabula. Anal sclerites bearing two pairs of setae. A pair of conical or papilliform tubercles present at posterior margin of body, at the tips of which are the openings of a pair of glands; these tubercles showing sexual dimorphism in the type species (fig. 3, E, F). Chelicerae of normal chelate form. Palpi five-segmented; tarsus with an erect solenidion at or slightly beyond the middle of the segment, immediately distad of which is a eupathid; three other eupathidia at tip of segment (fig. 3, H).

Anisochthodes papillifer, new species (figs. 1-3)

Female: Body (fig. 1, D) 351 to 369 μ long, 189 to 207 μ wide, length/width 1.74 to 1.86; average 360 μ long, 203 μ wide, length/width 1.77 (five specimens). Propodosoma delimited from hysterosoma by only a very feeble transverse line between the levels of the sensilla and the interlamellar setae. Lamellae feebly developed but always present, extending anteriorly to the lamellar setae and then anteroventrally over the margins of the rostrum as prolamellae (fig. 1, B). Lamellar and rostral setae both elongate, slender, moderately curved, directed anteriorly, very feebly pectinate. Interlamellar setae stiff and usually straight, extending posteriorly and dorsally. Translamella and cusps totally lacking. Sensilla capitate, extending anterolaterally and upward; swollen distal portion with margin appearing slightly spiny in full dorsal view. Parasensillar setae absent. Lateral portion of propodosoma with


A
B
C
D
E
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G

a distinct pore anterior to the insertion of the sensillum; with sculptured and punctate areas as shown in figure 1, B. Internal posterodorsal apodemes of propodosoma totally lacking. Dorsal surface of hysterosoma uniformly marked with circular panels which are larger in the anterior half than in the posterior half; with ten pairs of setae distributed more or less as shown in figure 1, D, variable in position (especially those behind the opening of the oil gland). A small pore a short distance directly behind the first pair of hysterosomal setae, and a similar pore slightly posteromediad of the opening of the oil gland. Opening of oil gland at posterior end of sac. Anterior to the opening of the oil gland is a slit pore. Extending posterolaterally from the origin of the lamellae is a pair of elongate grooves, tapering gradually and vanishing slightly behind the level of the first pair of hysterosomal setae. At the posterior end of the hysterosoma is a pair of prominent papillae, slightly excavated at the tip and containing a canal which continues internally as the duct of a subcuticular gland (fig. 3, E). Areae porosae absent.

Epimeral areas I, II, and III well delimited by apodemes 1, 2, sejugal, and 3, all of which reach to the well developed sternal apodeme. Sejugal apodeme well developed; but apodeme 4 totally absent. Epimeral area I with three setae, II with only one at the medial angle, III with one long seta near the anterior margin, IV completely open posteriorly and with three setae on each side. Tectopedia I and II not unusually developed. Discidium fairly well developed, forming a bidentate lobe as seen in ventral view. Immediately anterior to genital opening is a single pair of small setae, the alveoli of which are usually separated by a distance less than the diameter of one of the alveoli. Ventral plate with four pairs of setae behind genital opening distributed as shown in figure. Ventral surface marked with circular panels similar to those of dorsum. Three pairs of genital acetabula. Mature eggs very large, ranging up to 165 μ in length, never more than two present at one time, these nearly filling the hysterosoma. Anal sclerites bearing two pairs of setae, cuticle marked with minute circular panels.

Maxillae as shown in figure 1, G, with two pairs of setae; base of gnathosoma with a single pair as typical for Oribatei in general. Palpi five-segmented, femur and patella distinctly separated. Chaetotaxy of palp 0–2–1–3–10 (two specimens checked). Five of the tarsal setae are normal setae, extending from $0.24d^2$ to $0.68v$; while the others are a solenidion at $0.59d$ and four eupathidia distributed as shown in figure 3, H. Cheliceraein both male and female with one dorsal seta and one seta posteriorly near base of tarsus, Trägårdh's organ a long pointed membrane on the anterior surface (fig. 3, K). Jaws and teeth of chelicerae quite heavy. Trochanters I-IV each with a single seta. Femora

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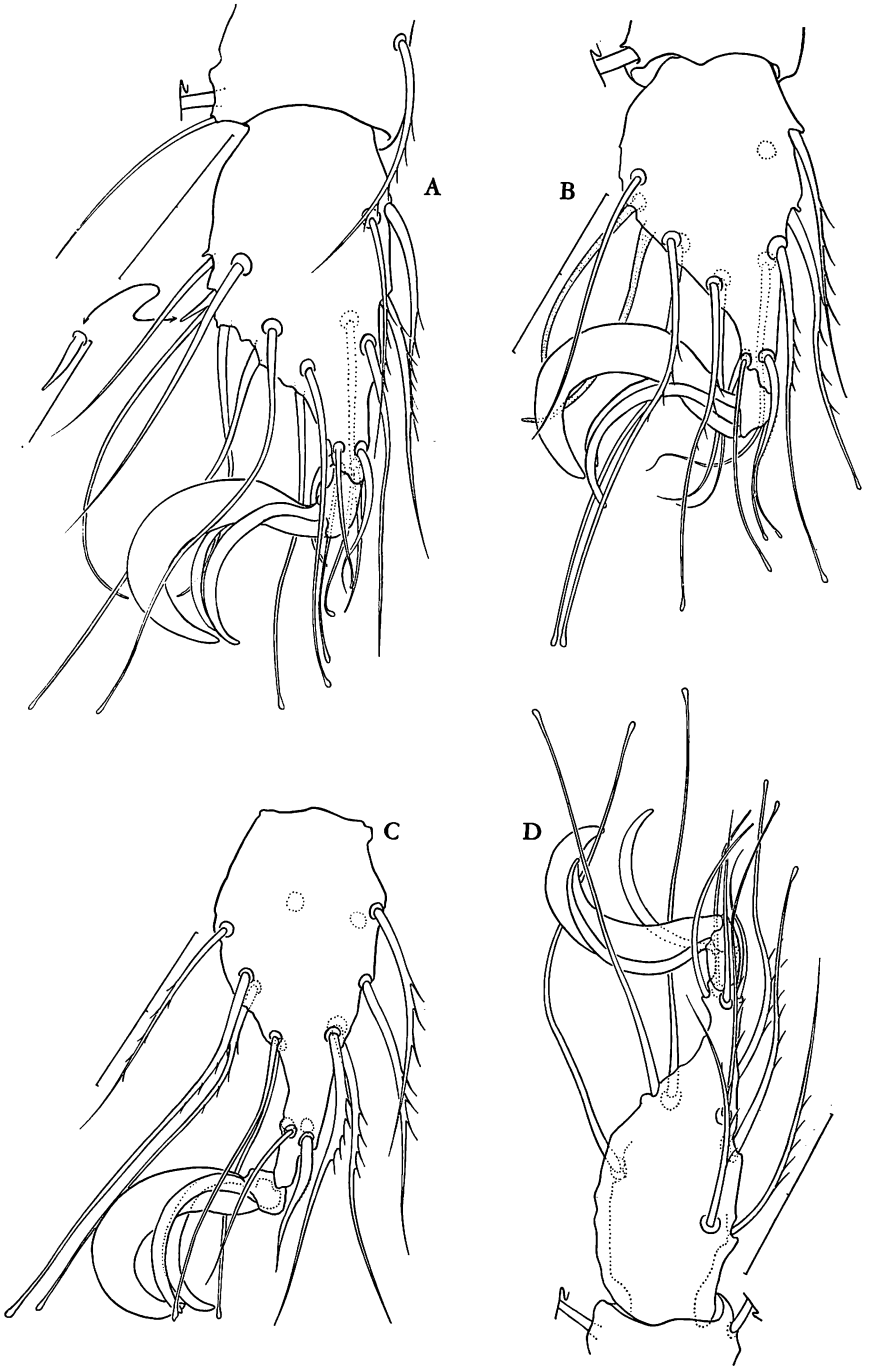
FIG. 1. *Anisochthodes papillifer*, n. sp. A, venter, female. B, detail of dorsolateral wall of propodosoma, female. C, sensillum, dorsal view, female. D, dorsum, female. E, detail of epimeral area and body margin, female. F, venter, male. G, palp and maxilla, female.


A
B
C
D

I and II each with two fairly stout hemipectinate setae dorsally, the basal one more erect than the distal one; dorsal setae of femur III moderately erect, but considerably more slender than those on I and II. Patella of legs I to III each with a dorsal solenidion, that on III quite short. Tibial solenidia numbering 2–1–1–1; both III and IV with a very long and typically formed solenidion.

Tarsus I with a slender, spike-like famulus at 0.41*d*, anterior to which are two slender, curved solenidia tapering to a moderately sharp point (fig. 2, A). At the end of the tarsus are the usual two pairs of setae, only the dorsal ones hollow basally, the ventral ones solid throughout; otherwise with 13 normal setae, seven of which are knob-like terminally.

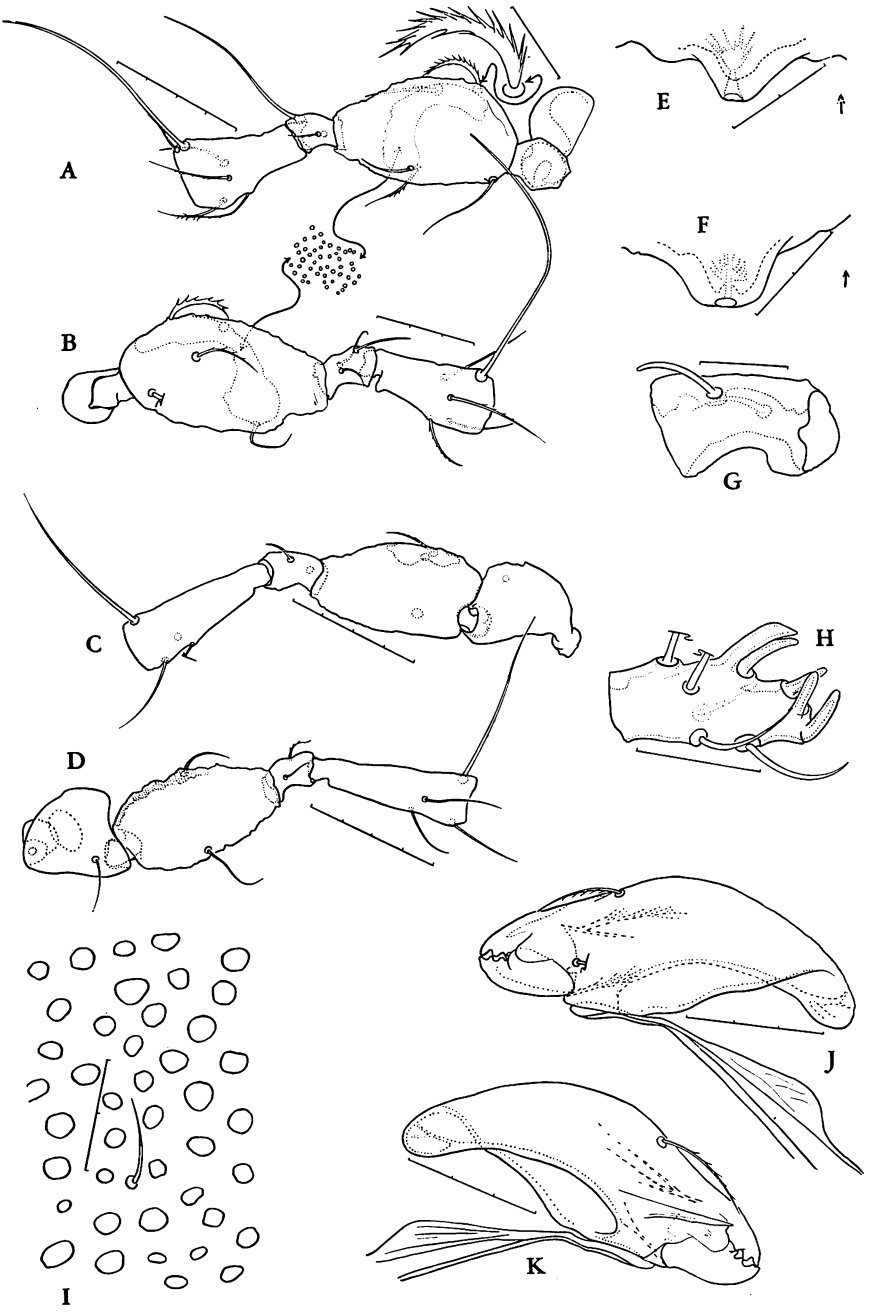
Tarsus II with no hollow eupathidia, although there are the usual two pairs of setae at the end of the segment. Capitate setae not so commonly enlarged as on I. Tarsi III and IV also without typical eupathidiform setae at end. Other details of chaetotaxy are shown in the accompanying table (s = solenidia, e = typical hollow eupathidia, f = famulus, n = normal setae, c = companion seta).

Male: Somewhat smaller than female, 297 to 351 μ long, 162 to 189 μ wide, length/width 1.75 to 1.86; average 324 by 170 μ, length/width 1.82 (five specimens). Similar to female in all other essential respects noted above except for the form of the papillae on the posterior end of the body. In the female these are quite sharply conical, but in the male they are distinctly more block-like in appearance (fig. 3, E, F). There is no intergradation, so that in the specimens observed by the writer it has always been possible to dis-

	TR	FE	PA		TI		TA				
	n	n	s	n	s	n	s	e	f	n	c
I	1	5	1	2	2	4	2	2	1	13	0
II	1	5	1	2	1	4	2	0	0	15	0
III	1	3	1	1	1	3	0	0	0	15	0
IV	1	2	0	2	1	3	0	0	0	12	0

[2] This convention was introduced by the writer at one point in an earlier paper (1956) without explanation. It is often desirable to indicate the precise position of particular setae or structures on the segments of a leg or palp, but this is usually laborious because of the lack of a system of notation which is both convenient and precise. The statement "Tarsus I with a famulus at 0.41*d*" is considerably briefer and more meaningful than such a statement as: "Tarsus I with a famulus dorsally, a little before the middle of the segment." The terms dorsal, ventral, anterior, and posterior (abbreviated *d*, *v*, *a*, *p*) are employed to express orientation with relationship to the longitudinal axis of the leg. The terms lateral and medial should not be used since the morphological meanings of these are reversed on legs I and II as compared with III and IV. The decimal always represents the distance from the *base* of the segment to the structure in question, divided by the total length of the segment, exclusive of the claws in the case of the tarsi.

FIG. 2. *Anisochthodes papillifer*, n. sp. A, tarsus I and insert of famulus, female. B, tarsus II, female. C, tarsus III, male. D, tarsus IV, female.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tinguish the sex of the mite by the shape of the papillae at the posterior margin of the hysterosoma. Sex can, of course, be verified by the form of the internal genitalia, as well as by the presence of eggs in gravid females. Of 56 specimens in the writer's collection, 39 are females and 17 are males. This is probably not indicative of the sex ratio in the population as a whole, since it is quite possible that there was an unconscious selection for large specimens when these were sorted for mounting.

Type locality: Kawaiiki Ridge, Oahu, Hawaii. On bark and leaves of 'ohi'a lehua, *Metrosideros collina* (Forst.) Gray *polymorpha* (Gaud.) Rock, June, 1953, collected by F. H. Haramoto. The species was very abundant at this locality. Syntypes are deposited in the Bernice P. Bishop Museum, Honolulu, and the United States National Museum.

Remarks: This genus runs to the family Carabodidae Willmann, 1931, in modern keys. This position should be regarded as provisional in view of the fact that the Carabodidae as now constituted probably do not comprise a natural family and are in considerable need of revision.

Tetracondyla Newell, 1956

One of the principal characteristics of this genus noted in the original description was the four-segmented palpi. Contrary to the description, however, this condition comes about through the fusion of the femur and patella, not through the fusion of the tibia and tarsus. The Oribatei are quite consistent in the chaetotaxy of the trochanter, femur, patella, and tibia of the palp, these segments typically having zero, two, one, and three setae, respectively (0–2–1–3). Overlooking one exceptional individual in the type series of *T. pallida* Newell, 1956, which had only two setae on the second segment of the palp, the first three segments of the palp normally have a setal formula of 0–3–3. The most logical interpretation of this is that the second segment represents the fused femur and the patella, and that the third segment is the tibia. This is further substantiated by the fact that in those Oribatei with five-segmented palpi the patellar seta is dorsal in position, the same position occupied by the most distal seta of the *second* segment of the palp of *T. pallida*. The diagnosis of the genus as well as its type species should be amended to read as follows: Palpi four-segmented, femur and patella fused. The fusion is complete in the type species, without even a trace of the suture.

FIG. 3. *Anisochthodes papillifer*, n. sp. A, trochanter-tibia I, male. B, trochanter-tibia II. male (with insert of porose area). C, trochanter-tibia III, male. D, trochanter-tibia IV, male. E. papilla and duct of gland, female. F, papilla and duct of gland, male. G, patella III, solenidion, male. H, palpal tarsus, female. I, cuticular detail of dorsum, female. J, chelicera, posterior, male. K, chelicera, anterior, male.

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