

Two New Species of Landhoppers (Crustacea: Talitridae) from O'ahu, Hawaiian Islands, with Redescription of *Platorchestia pickeringi* and Key to Landhoppers of O'ahu

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ABSTRACT

Two new species of terrestrial amphipod crustaceans, *Platorchestia lanipo*, n. sp., and *Hawaiorchestia gagnei*, n. sp., from the Ko'olau Mountains, O'ahu, are described. Another native Hawaiian landhopper, *Platorchestia pickeringi*, is redescribed, and a key is provided to the 7 species of landhoppers known to occur on O'ahu. *Orchestia kaalensis* and *Orchestia pickeringi* are placed in the genus *Platorchestia*.

INTRODUCTION

During a study of the altitudinal zonation of terrestrial amphipods (landhoppers) in the Ko'olau Mountains, O'ahu, 2 undescribed forms were encountered. Gagné (1975, quoting E. L. Bousfield) foreshadowed a considerable diversity of landhoppers in the Hawaiian Islands, and Bousfield (1984) has provided new genera to accommodate them, but only 2 native species have been described since the work of Dana (1853) in the last century: *Orchestia kaalensis* Barnard 1955 and *Spelaeorchestia koloana* Bousfield & Howarth 1976.

Three other species of landhoppers were found on the Ko'olau transect: 2 circumtropical tramp species, *Talitroides topitotum* (Burt 1934) and *T. alluaudi* (Chevreux 1901), and another Hawaiian endemic, *Platorchestia pickeringi* (Dana 1853) n. comb. Since the original account of *P. pickeringi* is brief, a comprehensive description is provided here. A key to these species and 2 others described from O'ahu, *Platorchestia kaalensis* (Barnard 1955) n. comb., and *Hawaiorchestia hawaiiensis* (Dana 1853), is given.

Types and paratypes are deposited in the Bishop Museum, Honolulu (BPBM), the Australian Museum, Sydney (AM), the Natural History Museum, London (BMNH), and the National Museum of Natural Sciences, Ottawa (NMNS). Other collections are housed in the Department of Zoology, University of Tasmania (UTZ).

The following codes are used in the figures: UL = upper lip; LL = lower lip; LMd = left mandible; RMd = right mandible; Mx1 = maxilla 1; Mx2 = maxilla 2; Mxpd = maxilliped; MP = distal segments of maxilliped palp; Gn1 = gnathopod 1; Gn2 = gnathopod 2; G2-6 = gill of gnathopod 2-gill of peraeopod 6; O2-5 = oostegite of gnathopod 2-oostegite of peraeopod 5; Pl1-3 = pleopods 1-3; U1-3 = uropods 1-3; Tel = telson. Figures in square brackets in the type material descriptions refer to the range of values observed in collections.

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Table 1. Comparison of some generic characters of *Platorchestia* Bousfield 1982 with *P. lanipo*, n. sp., *P. pickeringi* (Dana 1853), and *P. kaalensis* (Barnard 1955).

	<i>Platorchestia</i> Bousfield 1982	<i>P. lanipo</i> n. sp.	<i>P. pickeringi</i> (Dana 1853)	<i>P. kaalensis</i> (Barnard 1955)
Sexual dimorphism: antenna 2, P6 & P7	Strong	Weak	Moderate	Weak?
Maxilliped palp	Broad	Narrow	Narrow	Narrow?
Palm of male Gn2	Notched or sinuous	Smooth	Notched	Smooth
P4 dactyl	Strongly pinched or constricted	Not pinched	Not pinched	Not pinched?
P3 & P4: segment 5	Unequal; P4, set 5 often very short	± equal	P4, seg 5 slightly reduced	?
Abd. sideplates: hind margins	Weakly serrulate	Weakly serrulate	Smooth	Weakly serrulate
Pl2 & 3: spination of outer margins	Weakly spinulose	Weakly spinulose	Bare	?

P = peraeopod; Gn = gnathopod; Abd. = abdominal; Pl = pleopods.

SYSTEMATICS

Platorchestia Bousfield, 1982

This genus was erected to contain beachfleas and landhoppers from the northern Pacific, Japan, and the cosmopolitan *P. platensis* (Krøyer 1845). *P. lanipo*, n. sp. and *P. pickeringi* (Dana 1853), described below, and *P. kaalensis* (Barnard 1955) have been placed in this genus, pending description of other species in the Hawaiian landhopper fauna that may justify the erection of new genera.

These species differ from *Platorchestia* Bousfield in the weakly developed sexual dimorphism of antenna 2 and peraeopods 6 and 7 (especially *P. lanipo* n. sp. and *P. kaalensis*); relatively narrow maxilliped palp; weakly sinuous or smooth palm of male gnathopod 2 (*P. lanipo*, n. sp., and *P. kaalensis*); peraeopod 4 dactyl not strongly pinched; relative equality of peraeopods 3 and 4, without reduction of peraeopod 4, segment 5; nonserrulate hind margins of abdominal sideplates 1–3 (*P. pickeringi*); and lack of spinulation on the outer margins of the peduncles of pleopods 2 and 3. These differences are summarized in Table 1; they suggest that *P. lanipo*, n. sp., and *P. kaalensis* are more closely related to each other than to *P. pickeringi*.

Platorchestia lanipo Richardson, new species

Figs. 1–3

Diagnosis. Palm of male gnathopod 1 widened distally beyond dactyl into postpalmar, minutely spinose tumescence. Palm of male gnathopod 2 smoothly convex, dactyl smooth, $1.4 \times$ length of palm. Peraeopods 3–7 slender, elongate. Oostegites with 5–7 laterodistal setae. Gill of peraeopod 6 distally pointed. Pleopods reduced, 1 and 2 subequal, 3 about $0.75 \times$ length of 1 and 2, rami about $0.5 \times$ length of peduncle. Outer ramus of uropod 1 without nonterminal spines. Peduncle of uropod 3 bearing 3 spines. Telson as long as broad, terminally cleft, with 1 pair of lateral and 6 small terminal spines.

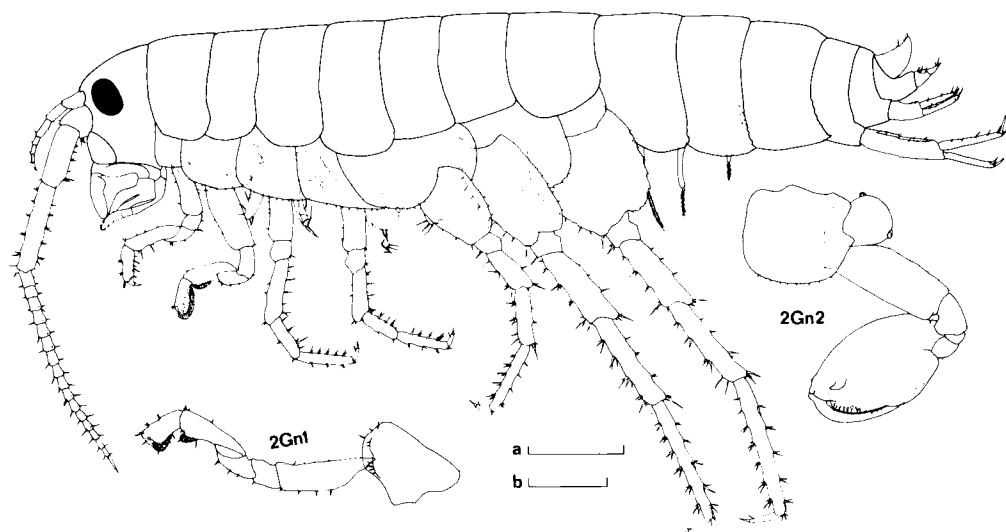


Fig. 1. *Platorchestia lanipo*, n. sp., holotype ♀ (8.5 mm), Lanipō Trail, Mau'ūmae Ridge, Ko'olau Mts, O'ahu; 2, allotype, ♂ (9.0 mm), Lanipō Trail, Mau'ūmae Ridge, Ko'olau Mts, O'ahu. Scale a (whole animal): 1.0 mm; scale b (2Gn1, 2Gn2): 0.5 mm.

Description. FEMALE. Length 8.5 mm, ovigerous, 3 eggs [3–8]. Body pale, grey or fawn in life, pigmentation turning red in alcohol, showing transverse stripes. Head capsule deeper than wide. Eye subovate, about $\frac{1}{3}$ width of head capsule. Antenna 1 short, not exceeding midpoint of peduncular segment 4 of antenna 2; flagellum shorter than peduncle, 4-segmented [3–5]. Antenna 2 relatively short, just exceeding length of head and 1st 4 pereon segments, peduncular segment 5 longer than rest of peduncle; flagellum longer than peduncle, 17-segmented [11–19], each segment bearing 4 bristles.

Upper lip fairly narrow, deep, apex moderately pilose. Lower lip broad, lateral lobes slightly divergent, inner shoulders and central cleft heavily pilose. Left mandible 6-cusped, lacinia mobilis 5-toothed, molar process strong, triturating surface with 22 ridges; right mandible, incisor 3-toothed, lacinia basically 2-cusped, with many small teeth. Maxilla 1, inner plate short, narrow, 2 terminal plumose setae; outer plate narrowing slightly distally, 2-segmented palp at midpoint of outer margin, apical spines strong, toothed; dentition formula 3–2–3–4–4–3–4–2–4. Maxilla 2, inner plate as broad, but shorter than outer plate, bearing spines distally and distomedially, setose medially, single plumose seta near midpoint of distal margin; outer plate apex rounded, lateral margin sparsely setose, distolateral spines longest, curved, inner spines shorter, blunt.

Maxilliped, inner plate fairly broad, apex truncate, bearing 2 spine teeth, outer larger than inner, 6–7 distal and 2 mesial plumose setae on medial face, lateral face with 2 plumose setae near the mesial margin. Outer plate apex rounded, medial face bearing 1 plumose seta distolaterally, lateral face with spines distally and distomesially. Palp robust, segments 1–3 each bearing a pair of spines distolaterally; segment 1 with 3 spines on the lateral surface distomesially, segments 2 and 3 spinose mesially and distomesially, segment 4 tiny and rounded, masked by distal spines on segment 3.

Gnathopod 1, coxa deep, broad, lightly spinose below. Segment 2 (basis) slightly elongate with spines on both margins. Segment 5 (carpus) elongate with spines on both margins. Segment 6 (propodus) shorter than segment 5, with almost no distal broadening, narrow palm,

posterior margin with numerous strong spines. Segment 7 (dactyl) strong, almost twice length of palm.

Gnathopod 2, coxa as deep as broad, lower margin rounded with small spines. Gill medium, anterior lobe tapering, rounded, posterior lobe deeper, blunt (this, and all gills, bearing numerous cysts). Oostegite not extending beyond segment 2, with 7 elongate, broad setae distally on anterior and posterior margins. Segment 2 (basis), posterior margin straight, anterior margin sinuous, spined. Segment 3 just exceeding segment 4, segment 4 bearing spines on posterior margin, segment 3 with small group of spines at the distal posterior corner. Segment 5 long, anterior margin bearing spines, long scabrous posterior lobe. Segment 6 shorter than segment 5 with long, deep, scabrous posterior lobe, small spines on lateral surface, no spines on anterior surface, except at hinge of dactyl.

Peraeopod 3, coxa square, spinulose below, posterior process small. Gill just shorter than segment 2, saclike. Oostegite \pm equal to segment 2, bearing 6 elongate, flattened setae on anterior and posterior distal margins. Segment 2 long, sparsely spinose anteriorly, segments 4–6 long. Dactyl with 2 small cusps extending over anterior proximal surface of nail.

Peraeopod 4, coxal plate square and with posterior process reduced. Gill shorter than segment 2, saclike. Oostegite \pm equal to segment 2, bearing 7 elongate, flattened setae. Segments 4, 5 and 6 rather narrow. Weakly cuspidactylate.

Peraeopod 5, extending beyond segment 5 of peraeopod 6, anterior coxal lobe larger, rounded, posterior lobe shallower and smaller with very few spines on lower and posterior margins. Gill small, saclike. Oostegite broad, extending halfway down segment 2, bearing 5 elongate, flattened setae. Segment 2 with anterior and posterior margins both rounded and spinulose. Segments 4 and 5 slightly broadened. Segment 6 elongate. Dactyl with 2 small cusps overlapping proximal posterior surface of nail.

Peraeopod 6, anterior coxal lobe vestigial, posterior lobe shallow, rounded, spinulose posteriorly. Gill simple, saclike, tapering to rounded point $<$ segment 1. Segment 2 spinulose on both margins, tapering slightly, with slight posterior extension. Segments 4–6 long, bearing strong spine groups. Dactyl long, weakly cuspidactylate, nail slightly curved.

Peraeopod 7, longest, coxal plate small, shallow, minutely spinulose behind. Segment 2 rounded with posterior extension, anterior margin spinose, posterior margin serrate and spinose. Segments 4–6 long, bearing strong spine groups. Dactyl long, weakly cuspidactylate, nail slightly curved.

Epimeral plate 1 shallow, lower margin square, with rounded posterior corner. Plate 2 deep, lower margin convex, hind margin serrulate, hind corner produced. Plate 3 as deep as plate 2, lower margin straight, hind margin serrulate, hind corner produced.

Pleopods reduced, all biramous, setose, 1 and 2 subequal, 3 about $\frac{3}{4}$ of 1 and 2, each with 2 coupling hooks, rami about $\frac{1}{2}$ peduncles, outer rami longer than inner, segmentation obscured, but rami with 5+ segments. First 2 peduncles subequal, 3rd about $\frac{3}{4}$ 1st 2.

Uropod 1, peduncle slender with 3 inner and 6 outer marginal spines, distolateral spine weak, small distoventral spine; rami subequal, shorter than peduncle, outer lacking marginal spines, but minutely spinose, inner with 3 marginal spines; outer ramus with 3 terminal spines, 1 large, inner ramus with 4 terminal spines, 1 large. Uropod 2, peduncle bearing 3 outer and 2 inner marginal spines; rami subequal and \pm equal to peduncle, outer ramus with 2 marginal and 4 terminal spines, inner ramus with 3 marginal and 5 terminal spines. Uropod 3, small, peduncle short, bearing 4 spines dorsally; ramus shorter than peduncle with 3 unequal terminal spines.

Telson broad, apex distinctly cleft, 2 large lateral spines each side, 1 large terminal spine each side, with 2 or 3 smaller associated spines.

MALE. Length 9 mm. Pigmentation showing transverse stripes, interrupted laterally, form-

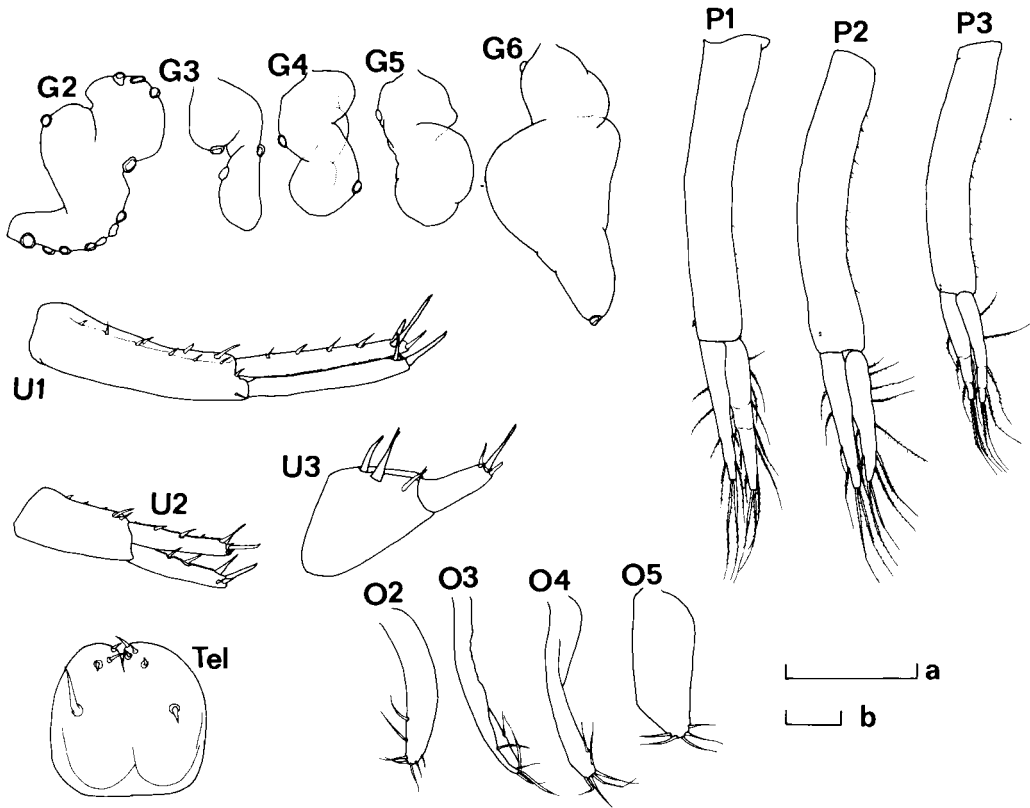


Fig. 2. *Platorchestia lanipo*, n. sp., holotype ♀ (8.5 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (G2-6, O2-5, U1, U2): 0.1 mm; scale b (P1-3, U3, Tel): 0.05 mm.

ing "nautilus" pattern. Antenna 1, more robust, flagellum 4-segmented, antenna 2 flagellum 18-segmented.

Gnathopod 1, segment 5 with minutely scabrous lobe on distal part of posterior margin. Segment 6 expanded distally, posterior margin and shoulder minutely scabrous. Dactyl slightly reduced, not exceeding palm.

Gnathopod 2, segment 2 anterior margin straight with 1 very small spine, posterior margin convex with few small spines, segments 3-5 reduced, broad. Segment 6 large, ovate, palm convex, strongly oblique, with weak row of spines. Dactyl strong, exceeding palm by $> \frac{1}{3}$, tapering, fitting palm closely.

Uropod 1 peduncle with 6 inner and 5 outer spines. Uropod 2 peduncle with 5 outer and 2 inner spines, outer ramus with 2 marginal and 3 terminal spines, inner ramus with 6 marginal and 4 terminal spines.

Telson with 1 large lateral spine and 2 terminal spines each side.

Otherwise as female.

Type material. Holotype ♀, HAWAII: O'AHU: Highest point of Lanipō Trail (2,520 ft), Mau'umae Ridge, Ko'olau Range, 7.X.1980, in moss on windward side of ridge (A.M.M. Richardson) (BPBM14563). Allotype ♂, same data as holotype. 6 ♀, 6 ♂, 4 juvenile paratypes, same as holotype, but 30.IX.1980, under moss (A.M.M. Richardson). 4 ♀, 3 ♂, 3 juvenile paratypes, same data, but 14.IX.1980, from moss 2 m up *Metrosideros collina* (A.M.M.

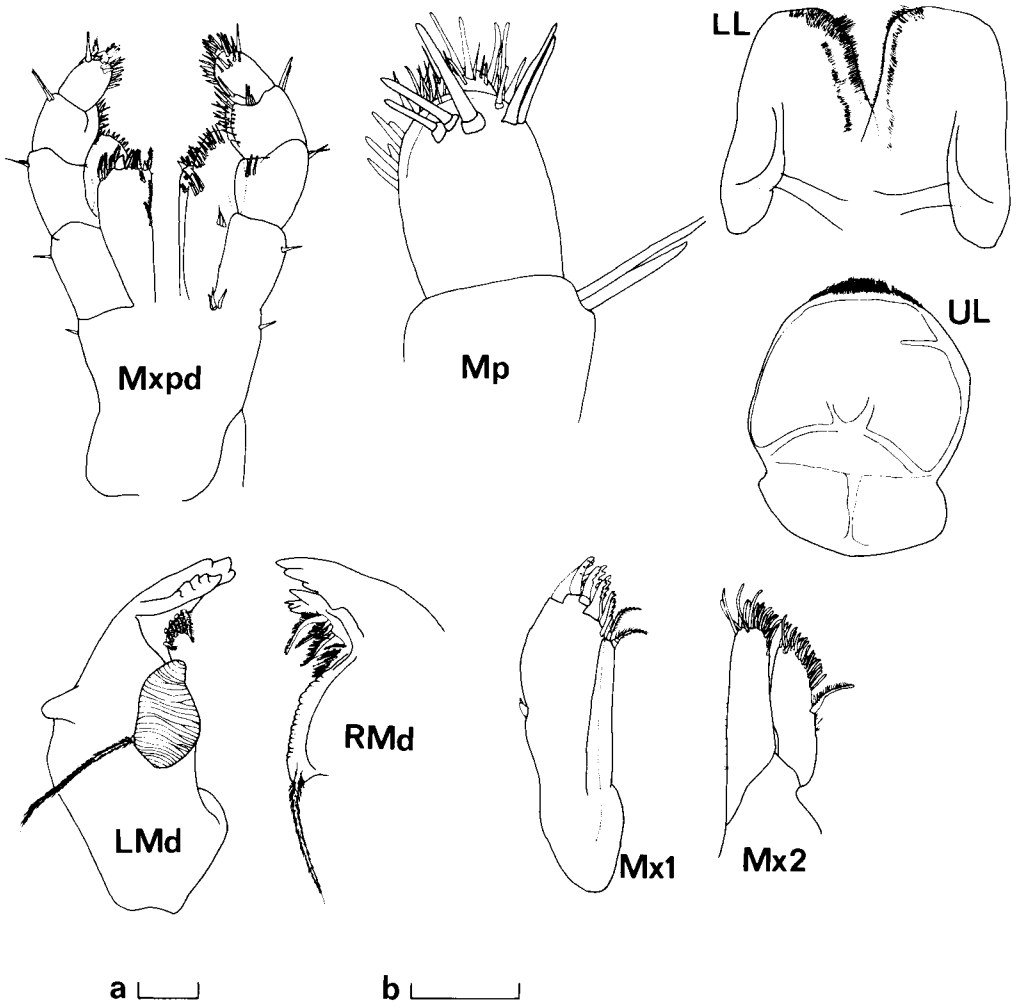


Fig. 3. *Platorchestia lanipo*, n. sp., holotype ♀ (8.5 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (Mxpd, Mx1, Mx2, LMd, RMd, UL, LL): 0.5mm; scale b (Mp): 0.1mm.

Richardson) (NMNS NMCC 1990–0583). 5 ♀, 7 ♂, 15 juvenile paratypes, same data, but 30.IX.1980, in moss on windward side of ridge (A.M.M. Richardson) (AM P40429). 3 ♀, 1 ♂, 1 juvenile paratype, HAWAI'I: O'AHU: Lanipō Trail (1,880 ft), Mau'umae Ridge, Ko'olau Range, thick moss under scrub, NW side of ridge (A.M.M. Richardson) (BMNH 1990:44:5). Holotype, allotype, and 16 paratypes in BPBM, 10 paratypes in NMNS, 27 paratypes in AM, 5 paratypes in BMNH.

Other specimens examined. HAWAI'I: O'AHU: 180 collections from Lanipō Trail, Mau'umae Ridge, Ko'olau Range, 30.IX.80–6.XI.80 (A.M.M. Richardson) (UTZ). 20+ specimens, Ko'olau Mountains, Poamoho Trail, 825 m, 15.IX.73, sifted from mosses under dense shrubs (W. C. Gagné) (NMNS). Moanalua Val, O'ahu, 16.X.77 (G. K. Uchida) (BPBM). 12 specimens, Ko'olau Mts, Schofield - Wai Kāne Trail, nr. Pu'uka'aumakua, 792 m (2,600 ft), 15.XII.73, sifting mossy leaf litter (W. C. Gagné) (NMNS). 12 specimens, Ko'olau Mts, Schofield - Wai Kāne Trail, nr. Pu'uka'aumakua, 777 m (2,550 ft), 15.XII.73, beaten from bases of *Machaerina angustifolia* (W. C. Gagné) (NMNS). 7 specimens, Poamoho Trail, about 1 mi above end of jeep trail, 609 m (2,000 ft), 12.I.74, sweeps from *Dicranopteris*

along trailside (E. L. Bousfield, S. Montgomery) (NMNS). 6+ specimens, Ko'olau Mts, Pu'ukahuuli, 789 m (2,590 ft), 9.IX.73, sifting mossy leaf litter (W. C. Gagné) (NMNS). 4 specimens, Kawailoa Forest Reserve, Pe'ahinai'a Trail, 750 m, 25.VIII.73, sifting mossy leaf litter (W. C. Gagné) (NMNS). 2 specimens, Kalihi Val, 27.IV.66, in debris (W. Voss) (NMNS). 2 specimens, Mt. Tantalus, 609 m (2,000 ft), 22.IV.61, Berlese funnel collection (Y. Miyatake) (NMNS). 1 specimen, upper plunge pool, Pālolo Stream, 300 m, 10.I.74 (F. G. Howarth, E. L. Bousfield) (NMNS). 1 specimen, Ko'olau Mts, Hau'ula Forest Reserve, 670 m (2,200 ft), 10.VI.73, in leaf litter and mosses (W. C. Gagné) (NMNS).

Remarks. There is some variation between collections in the length of the pleopods, but the consistent slight reduction in pleopod 3 and the lighter spination of the peduncle of uropod 3 distinguishes females of this species from *P. pickeringi*.

Etymology. The specific name refers to the Lanipō Trail, which climbs up Mau'umae Ridge to Pu'u Lanipō in the Ko'olau Range, on which the species was first collected.

***Hawaiorchestia gagnei* Richardson, new species**

Figs. 4–6

Diagnosis. Antenna 2 as long as head and 1st 7 peraeon segments. Carpus of gnathopod 1 (female) with minutely spined posterior tumescence. Palm of gnathopod 2 (male) propodus weakly sinuous. Pleopod 1 with 2 setose, unequal rami. Outer ramus of uropod 2 bearing 3 nonterminal spines. Gill of peraeopod 6 elongate, with terminal cleft and small posterior lobe.

Description. FEMALE. Length 11 mm, with no eggs [1–6]. Head deeper than long, eye sub-oval, width $\frac{1}{4}$ head length. Antenna 1 long, slender reaching almost to distal end of last peduncular segment of antenna 2; flagellum longer than peduncle, peduncle segment 3 equal in length to 1 + 2. Flagellum 7-segmented [5–8], penultimate segment slightly enlarged to give flagellum geniculate tip. Antenna 2 as long as head and 1st 7 peraeon segments, last segment of peduncle longer than preceding segments together; flagellum 19-segmented [16–20].

Upper lip rather narrow, deep, distally finely pilose, indentation of right margin prominent. Lower lip fairly broad, lateral lobes large, inner shoulder pilose, but pilosity not extending deep into central cleft. Left mandible 4-cusate, lacinia mobilis 4-toothed, molar process with 17 striations. Right mandible 4-cusate, lacinia 2-cusate, minutely toothed ridges running toward proximal end. Maxilla 1, inner plate only slightly shorter than outer, narrowing distally with sparse pilae on inner edge, plumes strong; outer plate broadening distally, beyond position of minutely 2-segmented palp, sparse pilae on inner margin; spine teeth strong, dentate, clustered; dentition formula 0–0–2–3–5–3–5–4–4. Maxilla 2, inner plate narrower than outer, plume on inner margin strong, distal spines decreasing in size toward apex, outer plate finely pilose on outer margin, laterodistal apex armed with 6–7 large spines, lateromesial spines shorter.

Maxilliped inner plate slender, broadening slightly distally to truncate apex bearing 4 unequal, bluntly rounded spine teeth, 5 plumose spines on the outer distal margin; inner margin with 1 short distal and 1 long proximal plumose spine, inner margin and surface lightly pilose. Outer plate just exceeding spine teeth of inner plate, outer margin arcuate, apex acute with group of sharp spines, inner margin with 2 rather weak groups of spines. Palp rather slender, segment 2 with narrow lateral lobe bearing 2 groups of spines, segment 3 with vestigial lateral lobe bearing 1 spine group. Segment 4 small, narrow, tapering slightly, bearing dense clump of terminal spines.

Gnathopod 1, coxa very weakly spinulose. Segment 2 broadening distally, spinose in front, weakly behind. Segment 5 long, with several medial spines and a minutely scabrous tumescence behind; segment 6 shorter, hind margin convex, corrugated, with strong spines, some medial spines; palm weakly defined, oblique.

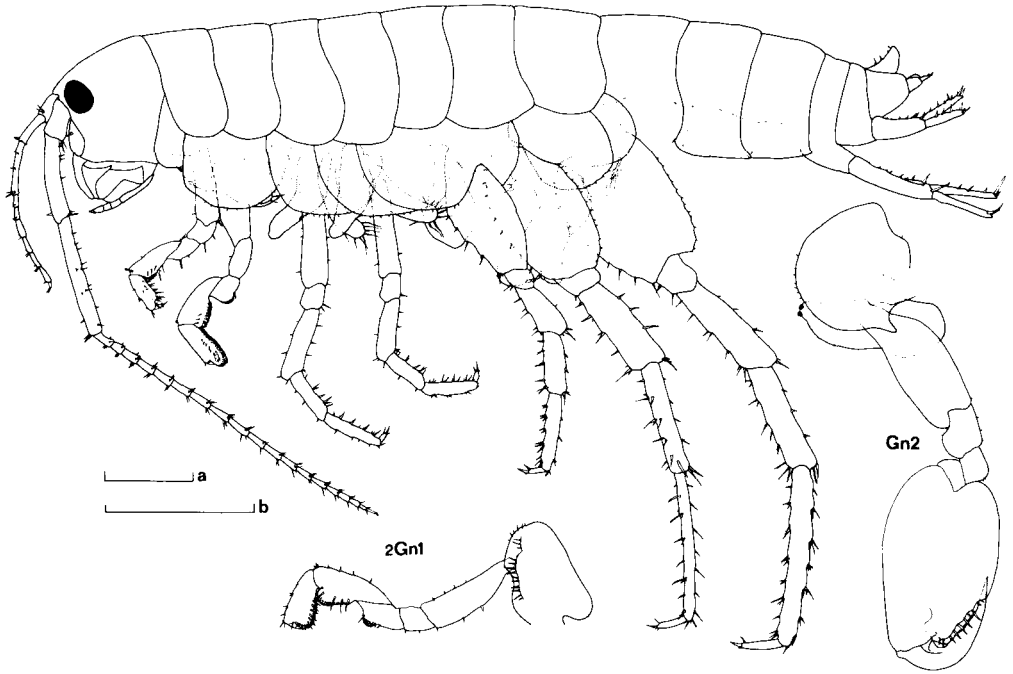


Fig. 4. *Hawaiorchestia gagnei*, n. sp., holotype ♀ (11.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu; 2: allotype ♂ (13.5 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (whole animal): 1.0 mm; scale b (2Gn1, 2Gn2): 1.0 mm.

Gnathopod 2, coxa large, broader than deep, smoothly convex, spinulose below, posterior process well defined. Gill large, proximally broad, anterior extension short, bluntly narrowing, bearing parasitic cysts. Oostegite narrow, about $\frac{1}{2}$ length of segment 2, 3 long setae at apex. Segment 2 broad, narrowing distally, anterior margin sinuous, very weakly spinose. Segment 3 longer than segment 4, latter with large posterior scabrous tumescence. Segment 5 broad with elongate scabrous blister and 3 medial spines. Segment 6 mitten-shaped, slightly elongate with posterior scabrous lobe and medial spines, anterior surface spineless, except for small spine cluster at articulation of dactyl.

Peraeopods 3 and 4, coxae large, broader than deep, coxa 3 convex and spinulose below, coxa 4 with lower margin almost straight, posterior processes well defined. Gills saclike; oostegites narrow, $\frac{2}{3}$ length of segment 2, bearing 9 and 8 elongate setae respectively. Second segments almost linear, that of peraeopod 3 broadening slightly distally. Segments 4–6 spinose in front and more strongly behind; dactyls weakly cuspidactylate, slender.

Peraeopod 5 long, extending to $\frac{1}{2}$ segment 6 of peraeopod 6, coxa broad, anterior lobe broader than deep, rounded below and spinulose, posterior lobe smaller, shallower, rounded behind. Gill simple, saclike; oostegite over $\frac{1}{2}$ as long as those of peraeopods 3 and 4, slightly broader, bearing 3 distal setae. Segment 2 slightly expanded with strong anterior spines. Segments 4–6 strongly spined in front and weakly behind, dactyl slender, weakly cuspidactylate, terminal spine long, curved.

Peraeopod 6 long, posterior coxal lobe shallow, curved, serrulate and weakly spinose below; gill large, extending to distal end of segment 2, cleft distally into 2 unequal lobes, the anterior being larger, 2 variable lobes on the proximal $\frac{1}{2}$, posterior larger. Segment 2 slender-ovate,

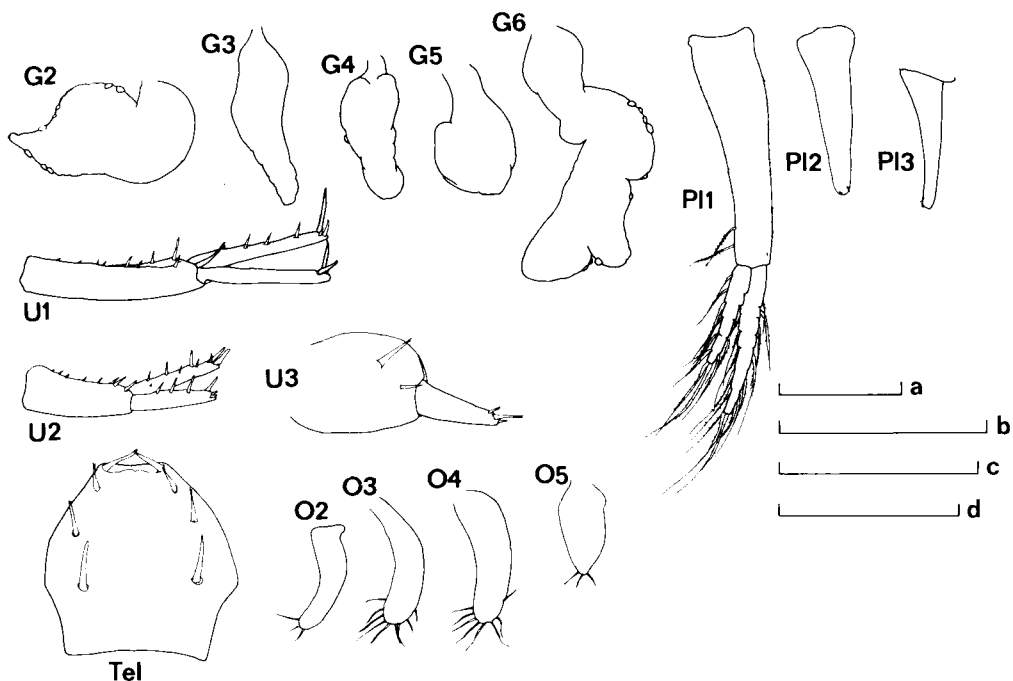


Fig. 5. *Hawaiorchestia gagnei*, n. sp., holotype ♀ (11.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (O2-5, G2-6): 1.0 mm; scale b (U1, U2): 1.0 mm; scale c (PI1-3, Tel): 0.5 mm; scale d (U3): 0.25 mm.

spinose, weakly serrulate behind. Segment 4-6 long, slender, with anterior and posterior groups of spines. Dactyl long, slender, weakly cuspidactylate, terminal spine curved.

Peraeopod 7 long, posterior coxal lobe small, shallow, smoothly curved with few spines. Segment 2 slender-ovate, spinose, weakly serrulate behind. Segments 4-6 long, slender with anterior and posterior groups of weak spines. Dactyl elongate, slender, weakly cuspidactylate, terminal spine curved.

Epimeral plate 1 deep, slightly shorter than epimeral plate 2, lower margin oblique anteriorly, rounded posteriorly, rear margin convex, smoothly rounded. Epimeral plate 2 as deep as plate 3, lower margin straight, anterior corner smoothly rounded, posterior corner produced to blunt point. Epimeral plate 3 margin straight below, anterior corner smoothly rounded, posterior corner almost square, with slight projection.

Pleopod 1 biramous, outer ramus shorter than inner. Peduncle margins clothed with minute hairs, 2 plumose setae on distal outer margin, 2 coupling hooks distally near inner margin. Rami bearing 2 plumose setae on each segment, outer ramus 6-segmented, inner ramus 8-segmented. Pleopod $2\frac{2}{3}$ length of peduncle of pleopod 1, peduncle bare except for 1 subterminal seta and 2 coupling hooks; pleopod $3\frac{2}{3}$ length pleopod 2, bare except for 1 subterminal seta and 2 coupling hooks.

Uropod 1 peduncle longer than rami, bearing 5 outer and 4 inner spines, distolateral (inter-ramal) spine long, curved; rami subequal margins of outer ramus naked, inner ramus bearing 4 subevenly spaced spines. Uropod 2 peduncle only just exceeding rami, bearing 2 inner and 5 outer spines; outer ramus slightly shorter than inner bearing 3 evenly spaced spines, inner ramus with 3 inner and 3 outer marginal spines. Uropod 3, peduncle broad, bearing 2 large outer and 2 small inner spines, ramus $\frac{2}{3}$ length of peduncle with 1 marginal spine and 1 large and 2 small spines at the apex.

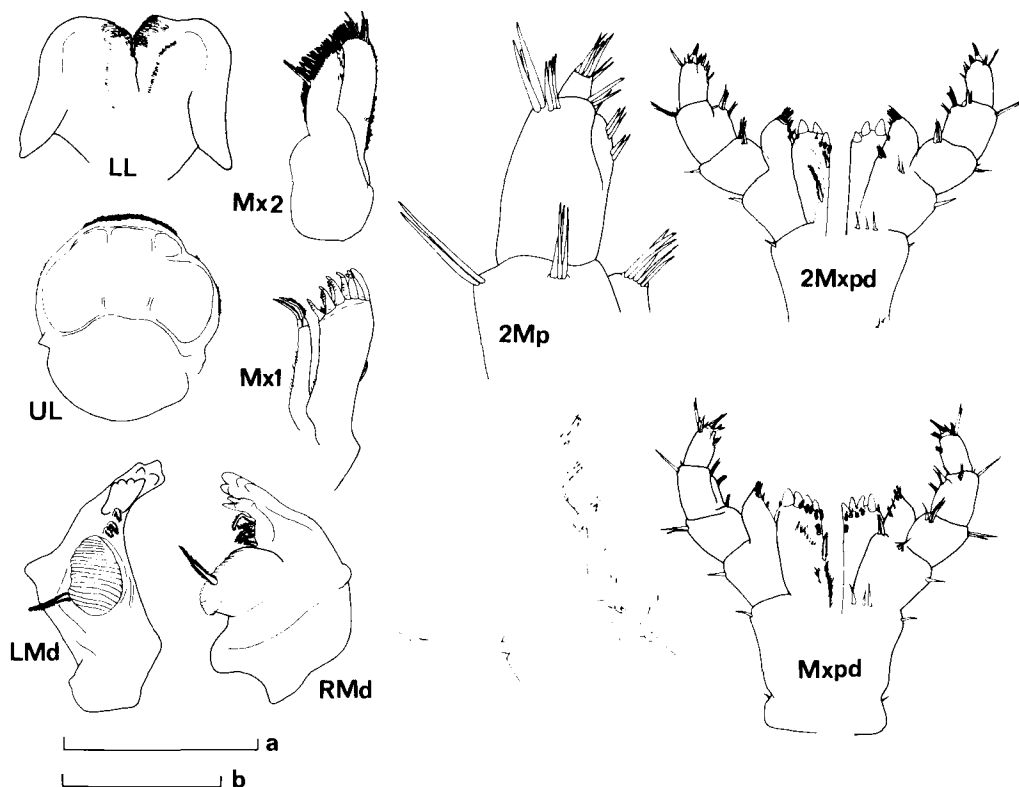


Fig. 6. *Hawaiorchestia gagnei*, n. sp., holotype ♀ (11.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu; 2: allotype ♂ (13.5 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (Mxpd, 2Mxpd, Mx1, Mx2, UL, LL, RMd, LMd): 0.5 mm; scale b (PD, 2PD): 0.1 mm.

Telson about as long as broad, narrowing distally, apex truncate, 3 marginal and 2 terminal bifid spines.

MALE. Length 13.5 mm. Antenna 1 flagellum 10-segmented, antenna 2 flagellum 24-segmented. Maxilliped inner plate bearing 3 unequal, bluntly rounded spine teeth, 4 plumose spines on the outer distal margin. Palp segment 3, vestigial lateral lobe bearing 4 evenly spaced spines.

Gnathopod 1, coxa spinulose anteriorly; segment 2 broadening distally, weakly spined in front and behind, segment 4 with narrow posterior scabrous tumescence, segment 5 with broad deep posterior scabrous lobe; segment 6 shorter than female, subchelate, posterior tumid lobe projecting beyond tip of dactyl.

Gnathopod 2, coxa and gill similar to female; segment 2 stronger, expanded distally; segments 3–5 reduced; segment 6 subovate, large, palm oblique, lined with evenly spaced spines; dactyl strong, exceeding palm to extend about $\frac{1}{2}$ length of segment 6.

Peraeopods 3–7 as female, except peraeopod 7, segment 2 more expanded posteriorly and posterior margin more strongly serrate.

Uropod 1, peduncle bearing 5 outer and 3 inner spines, inner ramus bearing 5 evenly spaced spines. Uropod 2, outer ramus bearing 5 spines, inner ramus bearing 4 outer and 4 inner spines. Uropod 3 ramus bearing 1 marginal spine with 1 large and 3 small apical spines. Telson with 3 small accessory spines on distal upper surface.

Otherwise as female.

Type material. Holotype ♀, HAWAII: O'AHU: Lanipō Trail (1,600 ft), Mau'umae Ridge, Ko'olau Range, 7.X.80, in *Freyinetia arborea* axils (A.M.M. Richardson) (BPBM 14564). Allotype ♂, same data as holotype. 5 ♀, 2 ♂, 2 juvenile paratypes, same data, but 3.X.80, litter under dense *Dicranopteris* thicket (A.M.M. Richardson). 3 ♀, 1 ♂ paratypes, same data, but (1,730 ft.), 7.X.80, in axils of *Freyinetia arborea* (A.M.M. Richardson) (NMNS NMCC1990-0584). 3 ♀, 1 ♂, 1 juvenile paratypes, same data, but (1,700 ft.), 3.X.80, litter under *Dicranopteris* (A.M.M. Richardson) (AM P40428). 4 ♀, 1 ♂, 6 juvenile paratypes, same data, but (1,700 ft.), 9.X.80, litter under *Acacia koa* etc. (A.M.M. Richardson) (BMNH 1990:45:11). Holotype, allotype, and 11 paratypes in BPBM, 4 paratypes in NMNS, 5 paratypes in AM, 11 paratypes in BMNH.

Other specimens examined. HAWAII: O'AHU: 189 collections from Lanipō Trail, Mau'umae Ridge, Ko'olau Range, 30.IX.80-6.X.80 (A.M.M. Richardson) (UTZ). 19 specimens, Ko'olau Mts, Hau'ula Forest Reserve, 670 m (2,200 ft), 10.VI.73, in leaf litter and mosses (W. C. Gagné) (NMNS). 17+ specimens, NE end of Wai'anae Val, 650 m, 13.I.74, in rotting branches of *Pisonia*, (F. G. Howarth) (NMNS). 11 ♀, 5 ♂, Manoa Cliffs Trail, Mt. Tantalus, O'ahu, 1 km from microwave station, 16.X.80, in ground litter, moss and perched litter on *Acacia koa* and in axils of *Freyinetia*, (A.M.M. Richardson) (UTZ). 11 specimens, Kawailoa Forest Reserve, Pe'ahināi'a Trail, 750 m, 25.VIII.73, sifting mossy litter (W. C. Gagné) (NMNS). 10 specimens, Poamoho Trail, about 1 mi above end of jeep trail, 609 m (2,000 ft), 12.I.74, sweeps from *Dicranopteris* along trailside (E. L. Bousfield, S. Montgomery) (NMNS). 1 ♀, 7 ♂, Pālolo Val, 10.I.74, tree fern (F. G. Howarth, E. L. Bousfield) (NMNS). 6+ specimens, NE end of Wai'anae Val, 650 m, 13.X.74, in rotting *Hibiscus arnottianus* wood (F. G. Howarth, W. C. Gagné) (NMNS). 6 specimens, Mt. Tantalus, 8.X.23 (S. C. Bell) (NMNS). 6 specimens, Pālolo Val, 10.I.74, lower plunge pool, tree fern (F. G. Howarth, E. L. Bousfield) (NMNS). 5 specimens, Ko'olau Mts, Poamoho Trail, 825 m, 15.IX.73, sifted from mosses under dense shrubs (W. C. Gagné) (NMNS). 2 specimens, Poamoho Stream, 487 m (1,600 ft), 12.I.73, *Cibotium* fronds (E. L. Bousfield, S. Montgomery) (NMNS). 2 specimens, Ko'olau Mts, Schofield - Wai Kāne Trail, nr. Pu'uka'aumakua, 792 m (2,600 ft), 15.XII.73, sifting mossy leaf litter (W. C. Gagné) (NMNS). 1 ♂, Mt. Tantalus, Ko'olau Mts, 30.IX.76, on taro (F. G. Howarth) (BPBM). 1 ♂, Moanalua Val, 16.X.77, on decayed log (G. K. Uchida) (BPBM).

Remarks. This species has been placed in the genus *Hawaiorchestia* Bousfield 1984, but it differs slightly from Bousfield's description in the following points: the female gnathopod 1 carpus is weakly tumescent behind; the male gnathopod 2 palm and dactyl are weakly sinuous; the 1st pleopod is biramous and setose; and the outer ramus of uropod 2 bears 3 nonterminal spines. The erection of a new genus for this species seems premature without examination of the undescribed species of *Hawaiorchestia* noted by Bousfield (1984).

H. gagnei, n. sp., appears to be identical to *Parorchestia hawaiiensis* as described and figured by Stebbing (1900), but the source of the animal figured by Stebbing is not clear from his account and he does not figure, or comment on, the condition of the pleopods in his material.

H. gagnei, n. sp., can be distinguished from *H. hawaiiensis* by the sinuous palm of the male 2nd gnathopod, the presence of spines on the outer ramus of uropod 2, and by the presence of setose rami on the 1st pleopod.

Etymology. This species is named after the late Dr. Wayne C. Gagné, who collected many landhoppers in the Hawaiian Islands.

***Platorchestia pickeringi* (Dana, 1853), new combination**

Figs. 7-9.

Orchestia Pickeringii Dana, 1853:882-3, plate 59, fig. 9a-f

Orchestia Pickeringii; Bate, 1862:32, 369, plate V, fig. 6

Orchestia pickeringii; Stebbing, 1900:528-9, plate XXIB (Vol. II)

Orchestia pickeringii; Stebbing, 1906:538

Orchestia pickeringii; Stebbing, 1910:645

Orchestia pickeringi; Stephensen, 1935:8

Orchestia pickeringi; Barnard, 1955:20–3, fig. 11a–p
Floresorchestia pickeringi; Bousfield, 1984:204, table 6
Floresorchestia pickeringii; Friend & Richardson, 1986:28

Diagnosis. Palm of male gnathopod 1 \pm equal to dactyl. Merus of female gnathopod 2 with small, minutely spined, posterior tumescence. Palm of male gnathopod 2 bearing 2 blunt, spined teeth, dactyl with posterior, spined swelling, $1.2 \times$ length of palm. Peraeopods 3–7 short, robust. Oostegites with 7–14 distolateral setae. Gill of peraeopod 6 distally rounded. Pleopods 1–3 subequal, rami just exceeding peduncles, 3rd ramus slightly reduced. Outer ramus of uropod 1 without nonterminal spines. Peduncle of uropod 3 bearing 4 spines. Telson as long as broad, terminally cleft.

Description. FEMALE. Length 15 mm, ovigerous, 2 eggs [2–11]. Body whitish in life with greenish pigmentation of antennae, tips of peraeopods and median dorsal stripe. Pigmentation turning red in alcohol. Head capsule deeper than wide. Eye subovate, about $\frac{1}{3}$ width of head capsule. Antenna 1 short, not exceeding peduncular segment 4 of antenna 2; flagellum shorter than peduncle, 4-segmented [3–5]. Antenna 2 relatively short exceeding the length of the head and 1st 4 peraeon segments, peduncular segment 5 longer than rest of peduncle; flagellum longer than peduncle, 16-segmented [13–18], each segment bearing 4 bristles.

Upper lip narrow, deep, apex moderately pilose. Lower lip, lateral lobes slightly divergent and lightly pilose basally, small pilose patch anterodistally, inner shoulders and central cleft heavily pilose. Left mandible 6-cusped, lacinia mobilis 5-toothed, molar process strong, triturating surface with 27 ridges; right mandible, incisor 7-toothed, lacinia 2-cusped, each tooth bearing many minor cusps. Maxilla 1, inner plate short, narrow, 2 terminal plumose setae; outer plate parallel sided, 2-segmented palp just basal of midpoint of outer margin, apical spines strong, toothed; dentition formula 4–5–3–4–4–4–5–4–5. Maxilla 2, inner plate almost as broad, but shorter than outer plate, bearing spines distally and distomedially, setose medially with a single plumose seta near midpoint of distal margin; outer plate apex rounded, lateral margin setose, distolateral spines longest, curved, inner spines shorter, blunt.

Maxilliped, inner plate fairly broad, apex rounded, bearing $3 \pm$ equal spine teeth, 4 plumose setae on lateral face, medial face with 2 inner marginal plumose setae. Outer plate apex rounded, medial face bearing 4 plumose setae distolaterally, lateral face with spines on inner margin. Palp robust, segments 1–3 with lateral lobes each bearing a pair of spines distolaterally; segment 1 with 5 spines on the ventral surface distomesially, segments 2 and 3 spinose mesially and distomesially, segment 4 tiny and rounded, masked by distal spines on segment 3.

Gnathopod 1, coxa rounded below. Segment 2 (basis) long with spines on both margins. Segment 5 (carpus) elongate with spines on both margins. Segment 6 (propodus) shorter than segment 5, with almost no distal broadening, narrow palm, posterior margin with numerous strong spines. Segment 7 (dactyl) strong, almost $2 \times$ length of palm.

Gnathopod 2, coxa as deep as broad, lower margin rounded with small spines. Gill medium, anterior lobe tapering, rounded, posterior lobe deeper, blunt. Oostegite extending just beyond segment 2 with 13 elongate, broad setae distally on anterior and posterior margins. Segment 2 (basis), posterior margin straight, anterior margin sinuous, spined. Segment 3 just exceeding segment 4, both bearing spines on posterior margin. Segment 4 with rounded scabrous posterodistal tumescence. Segment 5 long, anterior margin bearing spines, long scabrous posterior lobe. Segment 6 shorter than segment 5 with long, deep, scabrous posterior lobe, small spines on lateral surface, no spines on anterior surface except at hinge of dactyl.

Peraeopod 3, coxa spinulose below, rounded, narrowing slightly posteriorly, posterior process pronounced. Gill just shorter than segment 2, saclike. Oostegite as long as segment 2, bearing 14 elongate, flattened setae on anterior and posterior distal margins. Segment 2 long, segments 4–6 long. Dactyl with 2 strong cusps extending over anteroproximal surface of nail.

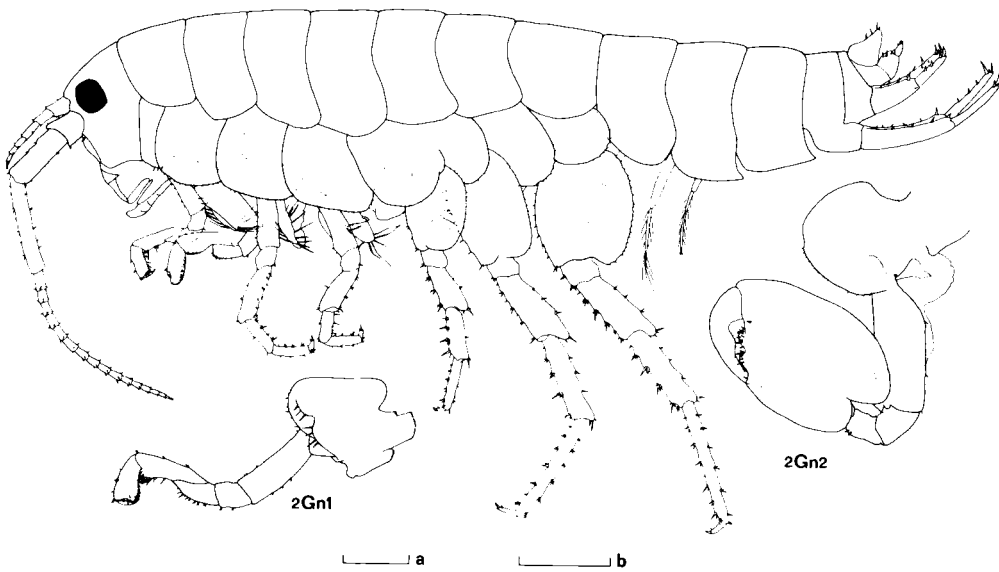


Fig. 7. *Platorchestia pickeringi* (Dana, 1853), ♀ (15.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu; 2: ♂ (13.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (whole animal): 1.0 mm; scale b (2Gn1, 2Gn2): 1.0 mm.

Peraeopod 4, similar to 3 but coxal plate more square and with posterior process greatly reduced. Gill longer than segment 2, saclike. Oostegite \pm equal to segment 2, bearing 11 elongate, flattened setae. Segments 4 and 5 shorter. Strongly cuspidactylate.

Peraeopod 5, extending to $\frac{1}{2}$ segment 5 of peraeopod 6, anterior coxal lobe larger, rounded, posterior lobe shallower and smaller with spinulose lower and posterior margins. Gill small, saclike. Oostegite hardly extending below coxa, bearing 7 elongate, flattened setae. Segment 2 with anterior and posterior margins both rounded and spinulose. Segments 4 and 5 quite broad and bearing groups of strong spines on anterior margins. Segment 6 elongate, with strong spines groups anteriorly. Dactyl shorter than those of peraeopods 6 and 7, bearing 2 strong cusps.

Peraeopod 6, anterior coxal lobe vestigial, posterior lobe shallow, rounded, spinulose posteriorly. Gill simple, saclike, bluntly rounded distally. Segment 2 spinulose on both margins, tapering slightly, with slight posterior extension. Segments 4–6 long, bearing strong spine groups. Dactyl long, strongly cuspidactylate, terminal spine slightly curved.

Peraeopod 7, longest, coxal plate small shallow, slight spinulose serration below and behind. Segment 2 rounded with large posterior extension, anterior margin spinose, posterior margin serrate and spinose. Segments 4–6 long, bearing strong spine groups. Dactyl long, strongly cuspidactylate, terminal spine slightly curved.

Epimeral plate 1 shallow, lower margin slightly rounded, hind margin serrulate, hind corner minutely produced. Plate 2 deep, lower margin convex, hind margin serrulate, hind corner produced. Plate 3 as deep as plate 2, lower margin straight and slightly oblique, hind margin serrulate, hind corner produced.

Pleopods all biramous, setose, subequal, each with 2 coupling hooks, rami just exceeding peduncles, outer rami longer than inner, segmentation slightly obscured, rami with 11+ segments. First 2 peduncles subequal, 3rd slightly shorter.

Uropod 1, peduncle slender with 5 inner and 6 outer marginal spines, distolateral spine weak, small distoventral spine; rami subequal, shorter than peduncle, outer lacking marginal spines,

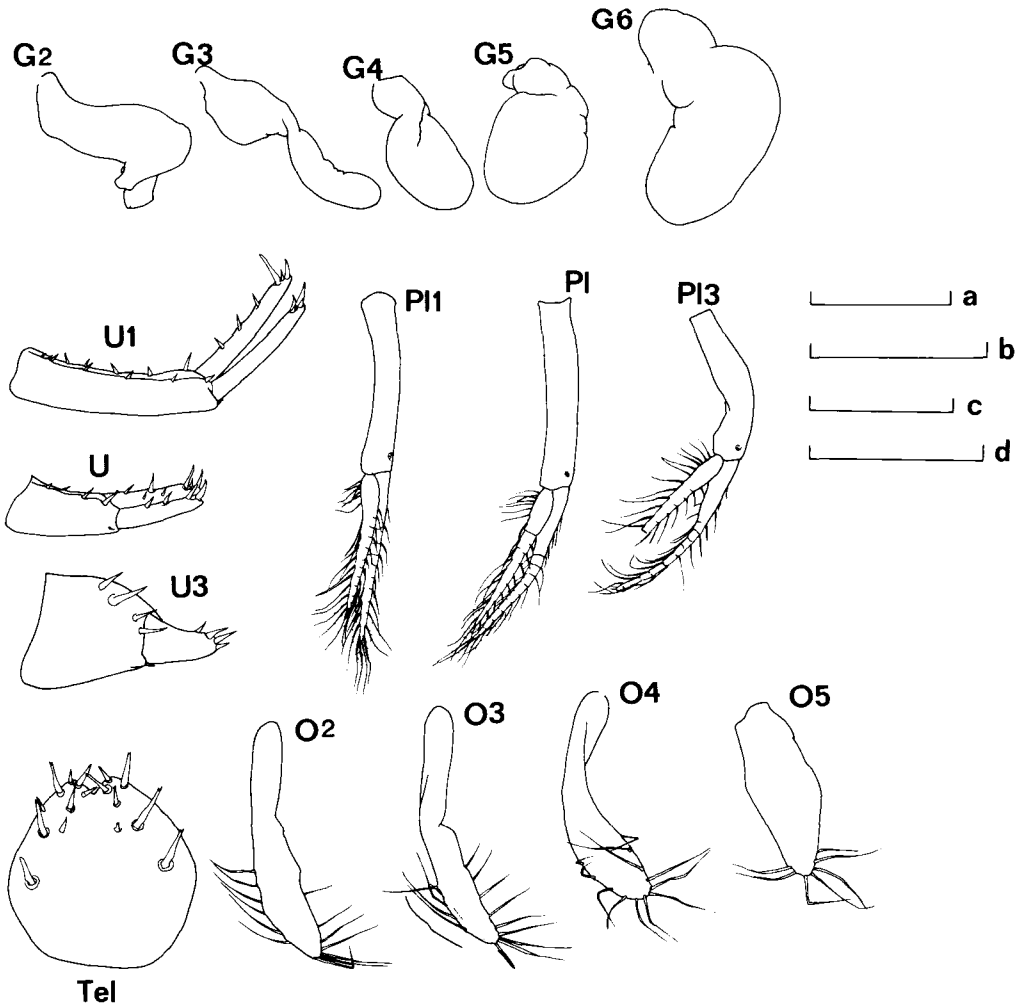


Fig. 8. *Platorchestia pickeringi* (Dana, 1853), ♀ (15.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (G2-6, U1, U2): 1.0 mm; scale b (O2-5, PI1-3): 1.0 mm; scale c (Tel): 0.5 mm; scale d (U3): 0.5 mm.

inner with 3; outer ramus with 4 terminal spines, 2 large with sinuous tips, inner ramus with 3 terminal spines, 2 large. Uropod 2, peduncle tapering distally, bearing 3 outer and 1 inner spine, small distoventral spine present; rami subequal and \pm equal to peduncle, outer ramus with 2 marginal and 2 terminal spines, inner ramus with 4 marginal and 3 terminal spines. Uropod 3, small peduncle short, bearing 4 spines dorsally and a small spine distoventrally; ramus shorter than peduncle with 4 unequal terminal spines.

Telson broad, apex distinctly cleft, bearing 2 large lateral spines each side with 1 or 2 associated smaller spines, 3 large terminal spines each side, with 1 or 2 smaller associated spines. Many large spines with bifid tips.

MALE. Length 13 mm. Antenna 1 flagellum 5-segmented, antenna 2 flagellum 16-segmented.

Lower lip lacking anterodistal pilose patch, shoulders less heavily pilose than female.

Maxilliped, inner plate bearing 4 blunt spine teeth distally, inner surface bearing 6 plumose

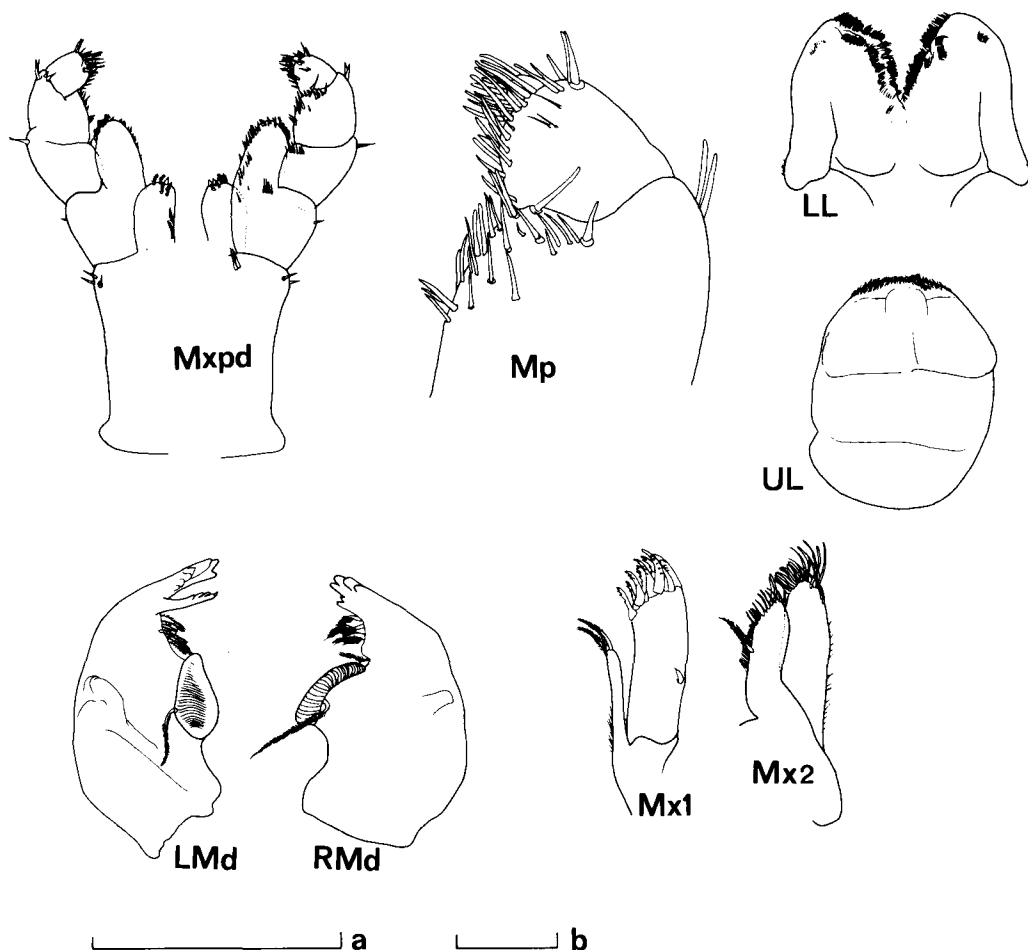


Fig. 9. *Platorchestia pickeringi* (Dana, 1853), ♀ (15.0 mm), Lanipō Trail, Mau'umae Ridge, Ko'olau Mts, O'ahu. Scale a (Mxpd, Mx1, Mx2, LMd, RMd, UL, LL): 0.5 mm; scale b (Pd): 0.05 mm. N.b. The maxilliped of the specimen illustrated is damaged; the inner plate normally extends to the distal margin of the outer plate.

setae on laterodistal margin, 6 plumose setae anteromesially and 1 plumose seta at the midpoint of the mesial margin. Outer plate bearing 4 plumose setae laterodistally.

Gnathopod 1, segment 5 with scabrous lobe on distal part of posterior margin. Segment 6 expanded distally, posterior margin and shoulder scabrous. Dactyl slightly reduced, not exceeding palm.

Gnathopod 2, gill elongate, extending further than midpoint of segment 2. Segments 3–5 reduced, broad. Segment 6 large, ovate, palm oblique, with 2 blunt teeth armed with spines. Dactyl strong, just exceeding palm, blunt, not fitting palm closely, with posterior marginal swelling bearing setae.

Telson with 1 large lateral spine on each side.

Otherwise as female.

Specimens examined. HAWAII: O'AHU: 36 collections from Lanipō Trail, Mau'umae Ridge, Ko'olau Range, 30.IX.80–6.XI.80 (A.M.M. Richardson) (UTZ). 9♀, 8♂, 12 immature, Mānoa Cliffs

Trail, Mt. Tantalus, 1 km from microwave station, 16.X.80, in ground litter, axils of *Freyinetia arborea* and *Cordyline* (A.M.M. Richardson) (UTZ). 12+ specimens, Poamoho Trail, 579 m (1,900 ft) 12.I.74, in *Freyinetia* (E. L. Bousfield) (NMNS). 12 specimens, Lanipō Trail summit, 7.XII.87 (J. Kalish) (UTZ). 11+ specimens, Ko'olau Mts, Poamoho Trail, 600 m, 27.I.73, in *Freyinetia* axils (F. G. Howarth, E. L. Bousfield) (NMNS). 1 specimen, Ko'olau Mts, Pe'ahinā'i'a Trail 609 m (2,000 ft), 28.X.73, beating *Freyinetia* (W. C. Gagné) (NMNS).

Key to the Landhoppers of O'ahu

1. Pleopods 1 & 2 biramous and setose, pleopod 3 reduced to a stump; gnathopod 2 not sexually dimorphic (**Talitroides**) 2
 Pleopods either all biramous and setose, or pleopod 1 only biramous and setose; gnathopod 2 greatly enlarged in males 3
2. Uropod 3 peduncle bearing 2 lateral spines; uropod 3 ramus relatively elongate, extending at least to distal edge of telson; telson distally emarginate; uropod 1 inter-ramal spine with complex tip **Talitroides topitotum** (Burt 1934)
 This circumtropical tramp species is abundant and dominates the amphipod community at lower altitudes of the Ko'olau Mountains
 Uropod 3 peduncle bearing single lateral spine; uropod 3 ramus minute, conical, not exceeding distal edge of telson; telson distally rounded; uropod 1 inter-ramal spine with simple tip **T. alluaudi** (Chevreux 1901)
 This species, also a circumtropical tramp, was rarely found on the Lanipō Trail, but is common in non-native vegetation at low altitudes elsewhere on O'ahu.
3. Antenna 1 extending at least to middle of last peduncular segment of antenna 2; pleopods 2 and 3 reduced, without rami; gill of peraeopod 6 elongate (**Hawaiorchestia**) 6
 Antenna 1 not extending beyond distal end of penultimate peduncular segment of antenna 2; all 3 pleopods biramous and setose; gill of peraeopod 6 saclike (**Platorchestia**) 4
4. Outer ramus of uropod 1 bearing 4 nonterminal spines **Platorchestia kaalensis** (Barnard 1955), **n. comb.**
 Described from material collected on Mt. Ka'ala, O'ahu, at 914 m (3,000 ft) altitude.
 Outer ramus of uropod 1 without nonterminal spines 5
5. Rami of pleopods \pm equal to peduncle, pleopods \pm equal in length; uropod 3 peduncle with 3–4 strong spines; oostegites with 7–14 marginal setae; male gnathopod 2 palm and dactyl notched **Platorchestia pickeringi** (Dana 1853), **n. comb.**
 Described from material collected from Mt. Ka'ala, O'ahu at 853 m (2,800 ft) altitude, in the axils of *Astelia*, but also collected widely in the Ko'olau Mts at high altitudes, usually in the axils of *Freyinetia arborea*.
 Peduncles of pleopods exceeding rami, pleopod 3 slightly reduced; uropod 3 peduncle with 3 spines; oostegites with 5–7 marginal setae; male gnathopod 2 palm and dactyl smooth **P. lanipo**, **n. sp.**
 Found in ground litter and in moss and litter above ground at a number of sites in the Ko'olau Mts at altitudes above 500 m.
6. Pleopod 1 biramous, rami setose; uropod 2 with nonterminal spines on outer ramus **Hawaiorchestia gagnei**, **n. sp.**
 Found in ground litter, in plant axils and Dicranopteris thickets above 360 m in the Ko'olau Mts
 Pleopods 1–3 reduced to stumps; uropod 2 without nonterminal spines on outer ramus **H. hawaiiensis** (Dana 1853)
 Described from material collected on Mt. Ka'ala, O'ahu.

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