

New species of *Bemlos* Shoemaker (Amphipoda, Senticaudata, Aoridae) from the Hawaiian Islands and Madagascar¹

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Abstract. A new species of aroid amphipod *Bemlos kaholaloa* **sp. nov.** is described from Hawai'i. It was collected from an autonomous reef monitoring structure deployed near Honolulu Harbor, O'ahu. The new species is compared with two sibling species, one from Micronesia and the other, also given new species status, from the Indian Ocean.

INTRODUCTION

During a study in 2018 of aquatic invasive species, by the State of Hawai'i's Division of Aquatic Resources, a previously undescribed species of aroid amphipod was discovered at Māmalā Bay in Oahu. It appeared to be closely allied to *Bemlos tridens* (Schellenberg) from Micronesia but differed from it in several important character states. Furthermore, material described from Madagascar by Ledoyer (1983) and attributed to *B. tridens* (Schellenberg) is found here to represent a third species in the *B. tridens* complex of species. The two new species, *Bemlos kaholaloa* **sp. nov.** (Hawai'i) and *B. ledoyeri* **sp. nov.** (Madagascar) are formally described and figured and compared with *B. tridens* (Schellenberg).

MATERIALS AND METHODS

Autonomous reef monitoring structures (ARMS) were used to monitor waters near state harbors for aquatic invasive species. ARMS are standardized structures designed to sample understudied marine cryptofauna passively (Global ARMS Program, 2017).

A modified ARMS, consisting of four plates rather than the standard nine, was deployed 10 July 2018 on a coral reef outside (southwest of the mouth of) Honolulu Harbor on the island of O'ahu, Hawai'i and retrieved approximately 34 months later. All crustaceans retained on a 2-mm sieve were fixed in formalin and preserved in alcohol. These were received on 10 September 2021. Unrecognized specimens were dissected following the procedure outlined in Barnard (1971). Body parts were mounted on glass slides, either temporarily in water or permanently with Permount mounting medium and observed on a Richter Optica UXID compound microscope outfitted with a 5 mega pixel camera. Type material is deposited at Bernice P. Bishop Museum, Honolulu (BPBM) and the Muséum National d'Histoire Naturelle, Paris (MNHN).

Abbreviations used in figures: G1, 2 = gnathopod 1, 2; Hd = head; L = labium; Md = mandible; Mx 2 = maxilla 2; U1, 2, 3 = uropods 1, 2, 3; SP = sternal processes; T = telson.

1. Contribution 2021-008 to the Hawaii Biological Survey.



Fig. 1. *Bemlos kahalaloa* sp. nov. male, 4.5 mm, Māmala Bay, O‘ahu, Hawai‘i.

SYSTEMATICS

Order AMPHIPODA Latreille, 1816
 Suborder SENTICAUDATA Lowry & Myers, 2013
 Infraorder COROPHIIDA Leach, 1814
 Superfamily AOROIDEA Stebbing, 1899
 Family AORIDAE Stebbing, 1899

Bemlos kahalaloa sp. nov.

(Figs. 1–2)

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Type material. Holotype ♂, 4.5 mm, Māmala Bay, O‘ahu (21.29575°N, 157.873097°W), 4.27 m, 13 May 2021, BPBM S18774.

Type locality. Māmala Bay, O‘ahu .

Etymology. From the Hawaiian place name of the reef from which the species was collected.

Description (based on male 4.5 mm).

Head. Lateral cephalic lobes obtuse, eye of medium size. *Antenna 1* about two thirds body length; peduncular articles in the ratio (basi-distal) 14:18:5; flagellum subequal to peduncle; accessory flagellum with 4 articles. *Antenna 2* about 80% the length of antenna 1; peduncular articles 4 and 5 equal in length; flagellum slightly longer than peduncular article 5, with 7 articles. *Maxilla 2* outer and inner plates subequal; inner plate with oblique setal row; *Mandible* palp article ratios (basi-distal) approximately 3:6:9; *Labium* mandibular projections acute.

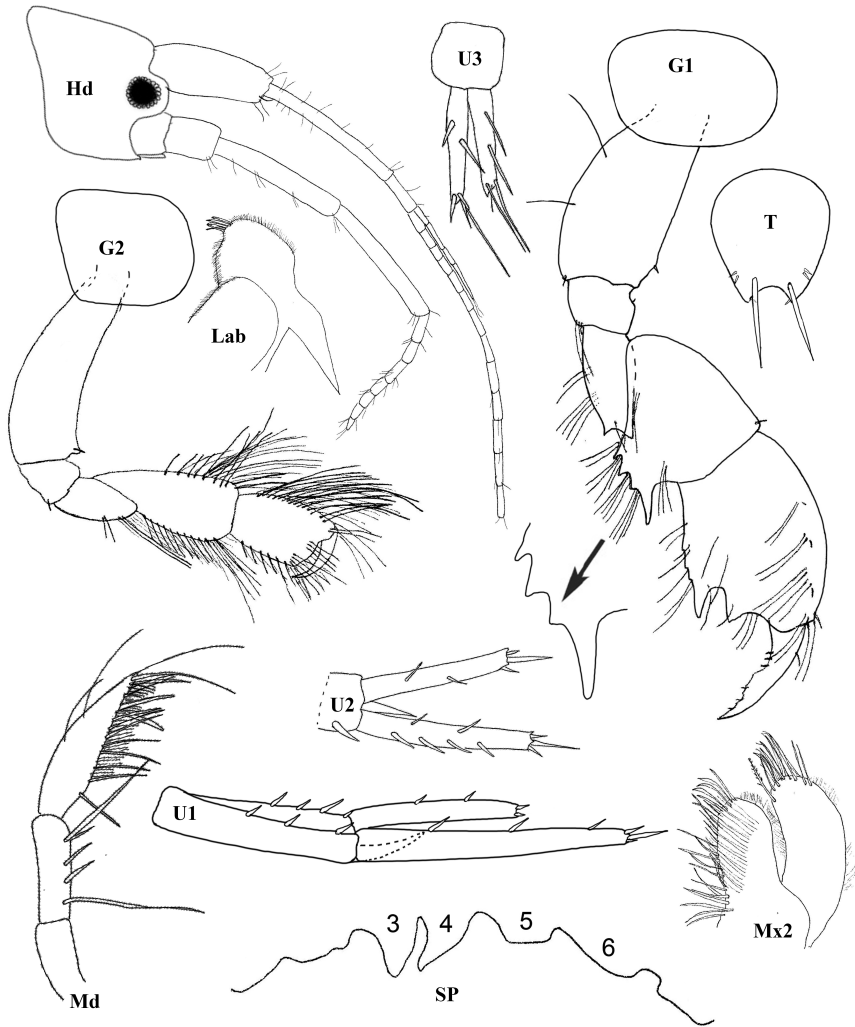


Fig. 2. *Bemlos kaholaloe* sp. nov. male, 4.5 mm, Māmala Bay, O’ahu, Hawai’i.

Pereon. *Color* (in alcohol): eyes dark; dark bands extend laterally on the dorsum of pereonites 2, 3, 5, 6, 7 and pleonites 1, 2; those on pereonites 2 and 5 widest. *Segments* with sternal spines, on segment 3 long, weakly acute and straight, on segment 4 very acute, produced forward, on segment 5 blunt. *Gnathopod 1* basis very stout, about twice as long as broad, anterior margin straight; merus with small posterodistal spine; carpus as broad as long, posterior margin produced into 4 spines, the most anterior one the longest, very acute, the second-most anterior blunt, the posterior third and fourth small, acute; pro-

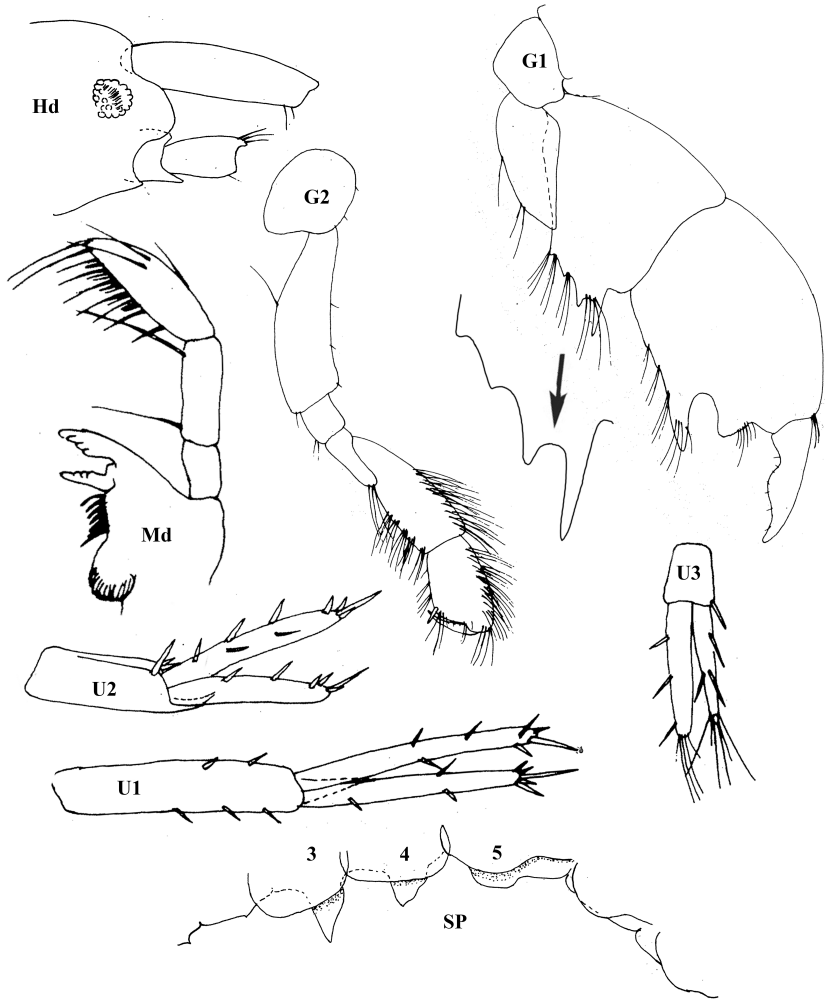


Fig. 3. *Bemlos ledoyeri* sp. nov. male, 5.0 mm, Grand Réciif de Tuléar, Madagascar (after Ledoyer, 1983 as *Bemlos tridens*).

podus longer than carpus, palm with deep distal excavation resulting in long slender defining spine; dactylus elongate, almost straight, posterior margin with shallow excavation, overlapping palm. *Gnathopod 2* coxa subround; basis elongate slender, anterior margin weakly concave, posterior margin convex; carpus elongate, twice as long as broad, anterodistal margin clothed in dense, long setae, posterodistal margin with long setae; propodus about two-thirds length of carpus, palm evenly convex, defined by a small robust seta; dactylus curved, slightly overlapping palm. *Pereopods* unknown.

Pleon. *Uropod 1* peduncle subequal with rami, with stout interramal spine about one third length of peduncle; endopodite much shorter than exopodite (perhaps regenerated). *Uropod 2* peduncle about three-quarters length of rami, with stout interramal spine almost half length of peduncle; endopodite longer than exopodite. *Uropod 3* peduncle scarcely longer than broad; rami moderately long, less than two times length of peduncle; endopodite shorter than exopodite; both rami with long slender apical setae and marginal robust setae. *Telson* with a single seta on each dorsolateral crest.

Habitat. Natural habitat unknown.

Distribution. Hawaiian endemic.

Remarks. *Bemlos kaholaloa sp. nov.* differs from *B. tridens* in the structure of the male sternal processes, of the male gnathopod 1 and of the uropods. In the male segment 3 of *Bemlos kaholaloa sp. nov.*, there is a stout triangular sternal process. In *B. tridens* this process is slender, curved forwards and acute. Segment 4 of *Bemlos kaholaloa sp. nov.* bears a forward directed acute sternal process, but this process is broad and truncated in *B. tridens*. Segment 5 bears a low flat-topped hump in *Bemlos kaholaloa sp. nov.*, but a tall, truncated plate in *B. tridens*. In the male gnathopod 1 the propodus is longer than the carpus in *Bemlos kaholaloa sp. nov.*, but carpus and propodus are subequal in *B. tridens*. The posterior margin of the carpus of *Bemlos kaholaloa sp. nov.* bears a long, slender posterodistal spine followed by 3 much shorter marginal spines. *B. tridens* has 3 identical shaped spines in disto-proximal graded sizes. In gnathopod 2, the basis and carpus are much less elongate and slender in *B. kaholaloa sp. nov.* than they are in either *B. tridens* or *B. ledoyeri*. The rami of uropod 3 in *Bemlos kaholaloa sp. nov.* are less than twice the length of the peduncle and only moderately slender but they are more than twice the length of the peduncle and very long and slender in both *B. tridens* and *B. ledoyeri sp. nov.*

Bemlos kaholaloa sp. nov. differs from *B. ledoyeri* in the long and acutely terminating article 3 of the mandibular palp (short and obtuse in *B. ledoyeri*), in the presence of a spine on the posterodistal margin of the merus (absent in *B. ledoyeri*), in the long acute process on sternite 4 of the male (short and triangular in *B. ledoyeri*) and in the shorter rami of uropod 3 (long in *B. ledoyeri*).

Bemlos ledoyeri sp. nov.

(Fig. 3)

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Microdeutopus tridens: Ledoyer, 1978: 255. Ledoyer 1979: 43, fig. 22; 1983: 302, fig. 112. (misidentification).

Type material. Holotype ♂, 4.5 mm, pente externe du Grand Réciif de Tuléar, 15 m depth. 3 slides. MNHN-IU-2008-22898 (= MNHN-Am3491) 1 M St 6-11-2 M. Peyrot-Clausade coll; MNHN-IU-2008-22898 (= MNHN-Am3491) 1 juv ? Cn 1-2 St 6-11-10 M. Peyrot-Clausade coll; MNHN-IU-2008-22898 (= MNHN-Am3491) 1 M Gn1 scu it St 6-11-4 M. Peyrot-Clausade coll.

Type locality. Tuléar Madagascar.

Etymology. Named for Michel Ledoyer in acknowledgement of his epic work on the amphipods of Madagascar.

Description (based on male 5.0 mm).

Head. Lateral cephalic lobes obtuse, eye of medium size. *Antenna* unknown. *Mandible* palp article ratios (basi-distal) approximately 3:6:10 *Labium* mandibular projections acute.

Pereon. *Segments* with sternal spines, on segment 3 long, acute and straight on segment 4 acute and irregular, on segment 5 weak. *Gnathopod 1* coxa unproduced, subquad-rangular; basis very stout, about twice as long as broad, anterior margin straight; merus lacking a posterodistal spine; carpus as broad as long, posterior margin produced into 4 spines, the most anterior one slender and the longest, the second most anterior of similar shape but shorter, the posterior 2 spines very small; propodus longer than carpus, palm with deep distal excavation resulting in long slender defining spine; dactylus stout and relatively straight, the posterior margin sinuous, medially swollen, fitting palm. *Gnathopod 2* coxa subround; basis elongate slender, anterior margin strongly concave, posterior margin strongly convex; carpus elongate, three times as long as broad, anterodistal and posterodistal margins clothed in dense setae; propodus about two-thirds length of carpus, palm evenly convex, defined by a small robust seta; dactylus curved, slightly overlapping palm. *Pereopods* unknown.

Pleon. *Epimera* rounded. *Uropod 1* peduncle and rami subequal in length, with stout interramal spine about one third length of peduncle; rami subequal in length. *Uropod 2* peduncle equal in length to exopodite and with stout interramal spine almost half length of peduncle; endopodite longer than exopodite. *Uropod 3* peduncle a little longer than broad; rami more than two times length of peduncle, very long and slender, endopodite shorter than exopodite; both rami with very long slender apical setae, endopodite and exopodite with marginal robust setae. *Telson* with a single long seta on each dorsolateral crest.

Habitat. Found to a depth of 15 meters on reef slopes in “very degraded” *Acropora* and *Acropora* with concretions.

Distribution. Indian Ocean: Toliara (Tuléar), Republic of Madagascar (Ledoyer 1979, 1983) and Republic of Mauritius (Ledoyer 1978).

Remarks. *Bemlos ledoyeri* differs from *B. tridens* in the structure of the sternal spines in the male. In *B. ledoyeri*, the spine on segment 3 is anteriorly straight whereas in *B. tridens* it is weakly concave, in *B. ledoyeri* the spine on segment 4 is short, and triangular whereas in *B. tridens* it is long and truncated and the spine on segment 5 in *B. ledoyeri* is a weak hump but a strong rectangular plate in *B. tridens*. The male gnathopod 1 of *B. ledoyeri* lacks a spine on the merus (present in both *B. tridens* and *B. kaholaloo*) has very different shaped spines on the posterior margin of the carpus (variable in shape in *B. ledoyeri* but uniform in shape although not in size in *B. tridens*), a propodus longer than the carpus (subequal in *B. tridens*) and a short dactylus with a sinuous posterior margin in *B. ledoyeri*, but a long dactylus with an even posterior margin in *B. tridens*.

For differences between this species and *B. kaholaloo* **sp. nov.** see remarks under that species.

Bemlos tridens (Schellenberg)

(Fig. 4)

Microdeutopus tridens Schellenberg, 1938: 74–75, fig. 38. Barnard 1965: 531, fig. 28f.

Lembos tridens Ren, 2006: 386–388, fig. 165.

Bemlos tridens Myers, 2012: 16, figs. 11, 12.

Description (based on male 4.0 mm)

Head. Lateral cephalic lobes obtuse, eye of medium size. *Antenna* unknown. *Mandible* palp article ratios (basi-distal) approximately 4:6:8 (Schellenberg) 4:7:11 (Myers); *Labium* mandibular projections acute.

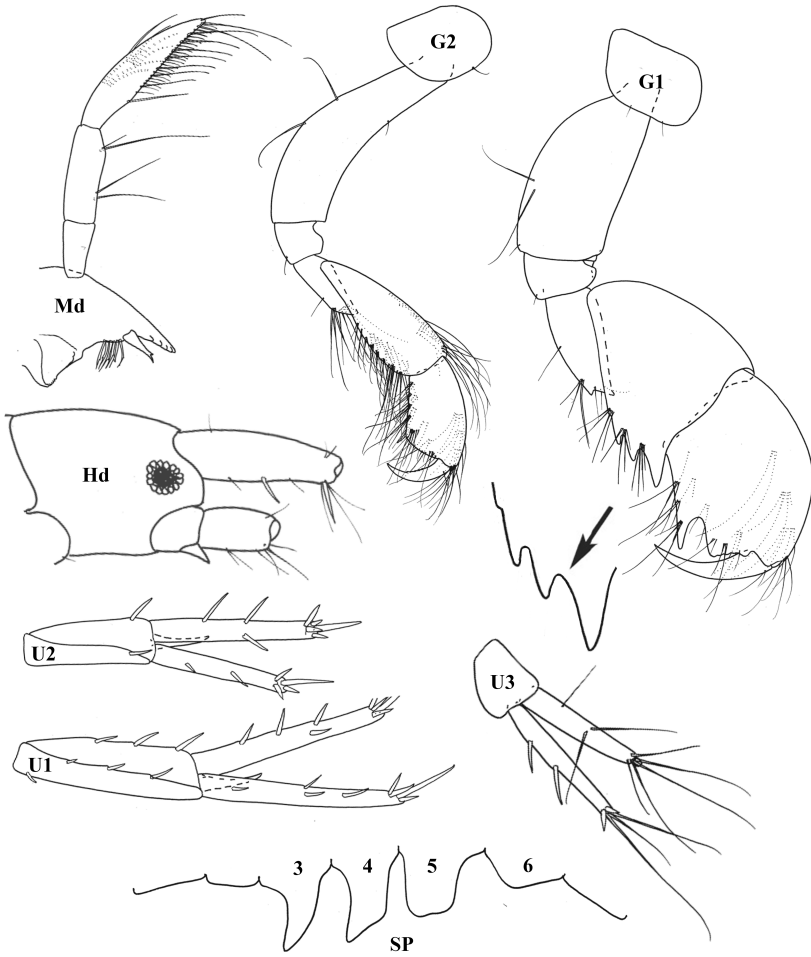


Fig. 4. *Bemlos tridens* (Schellenberg), male, 4.0 mm, Palau, Federated States of Micronesia (after Myers, 2012).

Pereon. Segments with sternal spines, on segment 3 long, acute and curved forwards, on segment 4 truncated, acute anterodistally, on segment 5 blunt, on segment 6 weak, triangular. *Gnathopod 1* coxa unproduced, rounded; basis very stout, about twice as long as broad, anterior margin straight; merus with small posterodistal spine; carpus as broad as long, posterior margin produced into 3 spines of identical shape, the most anterior one the longest, the most posterior one the shortest; propodus subequal in length with

carpus, palm with deep distal excavation resulting in long slender defining spine; dactylus elongate, strongly curved, narrowing uniformly distally, overlapping palm. *Gnathopod 2* coxa subround; basis elongate slender, anterior margin strongly concave, posterior margin strongly convex; carpus elongate, twice as long as broad, anterodistal margin clothed in dense, long setae, posterodistal margin with long setae; propodus about two-thirds length of carpus, palm evenly convex, defined by a small robust setae; dactylus curved, slightly overlapping palm. *Pereopods 3–4* similar; dactylus shorter than propodus. *Pereopods 5–6* basis slender. *Pereopod 7* unknown.

Pleon. *Epimera* rounded. *Uropod 1* peduncle a little shorter than rami, with stout interramal spine about one third length of peduncle; rami subequal in length. *Uropod 2* peduncle about three-quarters length of rami, with stout interramal spine almost half length of peduncle; endopodite longer than exopodite. *Uropod 3* peduncle scarcely longer than broad; rami more than two times length of peduncle, very long and slender, endopodite shorter than exopodite; both rami with very long slender apical setae, endopodite with three long, slender marginal setae; exopodite with 2 marginal robust setae. *Telson* with a pair of unequal setae on each dorsolateral crest.

Habitat. *Bemlos tridens* occurs intertidally and on reef flats and in a harbor channel, among live and dead coral heads, sponges, algae, and the seagrass *Enhalus*.

Distribution. Micronesia and South China Sea. Described from Abemama (Apamama) Atoll, Gilbert Islands, Republic of Kiribati (Schellenberg 1938), Ifalik Atoll, Yap State, Federated States of Micronesia and Enewetak Atoll, Republic of the Marshall Islands (Barnard 1965), Spratly (Nansha) Islands, South China Sea (Ren 2006) and Republic of Palau (Myers 2012).

Remarks. This species differs from both *B. ledoyeri* and *B. kaholaloa* **sp. nov.** in the structure of the male gnathopod 1. The carpus and propodus of that podomere are subequal in length (propodus longer than the carpus in both the other two species) and the spines on the posterior margin of the carpus are of identical shape, whereas in the other two species the spines are variable in shape. For other differences see the remarks sections under the other species.

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