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Taxonomic Exploration of Rare Amphipods: A New Genus and Two New Species (Amphipoda, Iphimedioidea, Laphystiopsidae) Described from Seamounts in the Western Pacific †

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Abstract: During two expeditions to the seamounts in the Yap-Caroline area of the Western Pacific, a new genus, *Phoxirostus* gen. nov., in the family Laphystiopsidae Stebbing, 1899, is erected for two new species, *P. longicarpus* sp. nov. (type species) and *P. yapensis* sp. nov. The new genus can be distinguished from the other three laphystiopsid genera by the acute rostrum not overreaching the distal end of the first peduncular article of antenna 1, the outer plate of maxilla 1 bearing 10–11 spines, and the elongated carpus of pereopods 3–7 being distinctly longer than half the length of the propodus. *Phoxirostus longicarpus* sp. nov. differs from *P. yapensis* sp. nov. by the shape of the eyes and coxa 4, the presence of posterodistal protrusions on pleonite 1, and the number of posterodistal protrusions on pleonite 2. Generic analysis of one mitochondrial (COI) and one nuclear (H3) gene using maximum likelihood and Bayesian inference clarified the phylogenetic position of the Laphystiopsidae within the superfamily Iphimedioidea Boeck, 1871.

Keywords: deep sea; *Phoxirostus* gen. nov.; new species; taxonomy; morphology

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1. Introduction

The family Laphystiopsidae Stebbing, 1899, currently containing eight species within three genera, includes members that are widely reported in the Pacific, Atlantic, Indian, and Antarctic Oceans at a depth ranging from 50 to 2500 m [1–5]. Laphystiopsids are characterized by very short nonacuminate coxae, feeble gnathopods, and huge oostegites [5]. Three laphystiopsids have been reported in deep waters, and two of them, *Laphystiopsis zomerysis* Barnard, 1999, and *Prolaphystiopsis ornithorhynchus* (Bulyčeva, 1952), are reported in the Pacific [5].

During a biodiversity survey of the seamounts in the Yap-Caroline area of the Western Pacific in 2014 and 2019, the specimens referred to the families Laphystiopsidae Stebbing, 1899, were collected. After careful examination, they were identified as two new species exhibiting distinctive characteristics, differentiating them from all Laphystiopsidae species. Hence, a new genus was also erected to accommodate these two new species. Their descriptions and illustrations are provided herein.

2. Materials and Methods

2.1. Collection and Preservation

Specimens were collected from seamounts in the Yap-Caroline area of the Western Pacific. The animals were sorted on board and fixed in 96% ethanol and then transferred to 75% ethanol in the laboratory for further study. The type of material was deposited at the Marine Biological Museum of the Chinese Academy of Sciences (MBMCAS), Qingdao, China. External morphology and internal anatomy were examined, dissected, and photographed under a stereomicroscope (ZEISS Discovery V20, Oberkochen, Germany). The length measurement was made along the outline of the animal, beginning from the anterior margin of the head to the posterior margin of the telson. Line drawings were made using Adobe Photoshop CS6 (13.0) with a graphics tablet (Wacom PTH 851, Saitama, Japan).

2.2. DNA Extraction, Sequencing, and Phylogenetic Analyses

Only one specimen of *Phoxirostus longicarpus* sp. nov. was picked for gene extraction. DNA was obtained from its mitochondrial genome by a homologous alignment: cytochrome oxidase I (COI, 417 bp) and histone 3 (H3, 305 bp). We included data of 17 species belonging to 7 families within the superfamily Iphimedioidea Boeck, 1871, and one outgroup species, *Bactrurus brachycaudus* Hubricht and Mackin, 1940, within the family Crangonyctidae Bousfield, 1973, was encompassed in the phylogenetic analysis (Table 1).

Table 1. Samples and GenBank accession numbers used in this study. New sequences are highlighted in bold; N/A, not available.

Taxon	COI	H3
Acanthonotozomatidae Stebbing, 1906		
Acanthonotozoma inflatum (Krøyer, 1842)	N/A	KJ530648
Acanthonotozomellidae Coleman and J.L. Barnard, 1991		
Acanthonotozomella trispinosa (Bellan-Santini, 1972)	KY907618	KY825836
Dikwidae Coleman and J.L. Barnard, 1991		
Dikwa andresi Lörz and Coleman, 2003	KY907614	KY825833
Epimeriidae Boeck, 1871		
Epimeria aff. *similis* Chevreux, 1912	KU870895	KY825955
Epimeria aff. *similis* Chevreux, 1912	KU870865	KY825885
Epimeria aff. *georgiana* Schellenberg, 1931	KU870894	KY825952
Epimeria aff. *puncticulata* K.H. Barnard, 1930	KU870888	KY825933
Epimeria aff. *pulchra* Coleman, 1990	KU870881	KY825925
Epimeria cornigera (Fabricius, 1779)	KY907659	KY825950
Epimeria loricata G.O. Sars, 1879	KY907626	KY825847
Epimeria robusta K.H. Barnard, 1930	KU870854	KY825866
Epimeria walkeri (K.H. Barnard, 1930)	KU870819	N/A
Iphimediidae Boeck, 1871		
Anchiphimedia dorsalis K.H. Barnard, 1930	KY907612	KY825816
Gnathiphimedia sexdentata (Schellenberg, 1926)	KU870835	KY825841
Stilipedidae Holmes, 1908		
Alexandrella dentata Chevreux, 1912	KY907619	KY825837
Astyra abyssi Boeck, 1871	KY907617	KY825835
Vicmusiidae Just, 1990		
Acanthonotozomopsis pushkini (Bushueva, 1978)	KY907620	KY825838
Crangonyctidae Bousfield, 1973		
Bactrurus brachycaudus Hubricht and Mackin, 1940	MN175619	KF484707
Laphystiopsidae		
***Phoxirostus longicarpus* gen. et ap. nov.**	**PQ193948**	**PQ268529**

The sequences obtained were aligned using MEGA 6 [6] and concatenated using SequenceMatrix 1.8 [7], resulting in a combined sequence length of 722 bp. Phylogenetic trees were constructed by two methods: Bayesian inference (BI) and maximum likelihood (ML). The optimal evolutionary model for each dataset was determined with jModelTest

0.1.1 based on the Akaike information criterion (AIC) [8]. Bayesian analyses were performed with MrBayes 3.2.7 [9], employing a Markov Chain Monte Carlo (MCMC) algorithm with two runs, each consisting of four chains, for 1,000,000 generations and sampling trees every 500 generations, resulting in a total of 2000 sampled trees. The effective sample size (ESS) values for all sampling parameters were assessed with Tracer v1.7 [10]. The initial 500 trees were discarded as burn-in, and posterior probabilities (PPs) were calculated from the remaining trees. ML analyses were carried out online using W-IQ-TREE (http://iqtree.cibiv.univie.ac.at/, accessed on 30 July 2024) [11], with clade support evaluated through 10,000 ML bootstrap replications.

3. Results

3.1. Taxonomy

Laphystiopsidae Stebbing, 1899.

Diagnosis (modified from [5])—Rostrum present or absent, if present acute or very broad, reaching at least half length of first peduncular article of antenna 1. Accessory flagellum absent or uniarticulate. Field of mouthparts quadrangular. Mandibular molar triturative or not; accessory spines with 1–5 robust simple seta or absent. Inner plate of maxilla 1 feeble, poorly setose (1–2 seta or naked), outer plate with 5–7 or 10–11 spines; palp uniarticulate or biarticulate. Palp of maxilliped 4-articulate. Coxae 1–4 small, quadrate or rectangular or ovate, occasionally disjunct from each other. Gnathopods 1–2 feeble, simple. Urosomites free. Uropod 3 biramous, outer ramus longer than peduncle. Telson short, entire.

Key to genera of Laphystiopsidae (modified from Barnard 1999).

1. Rostrum acute, not spatulate; maxilla 1 with inner plate bearing 2 apical setae, outer plate with 10–11 spines; telson rectangular
Phoxirostus gen. nov.
-. Rostrum spatulate, or absent; maxilla 1 with inner plate bearing 0–1 apical seta, outer plate with 5–7 spines; telson oval
2
2. Rostrum absent; coxa 4 almost as long as broad, deeply excavate posteriorly
Prolaphystius KH Barnard, 1930
-. Rostrum present; coxa 4 small, much wider than long, not excavate posteriorly
3
3. Peduncular article 1 of antenna 1 having apical projection; rostrum apically constricted, margin rounded; eye lobes strongly bulging
Prolaphystiopsis Schellenberg, 1931
-. Peduncular article 1 of antenna 1 lacking apical projection; rostrum not constricted, truncate; eye lobes not bulging
Laphystiopsis GO Sars, 1893

Phoxirostus gen. nov.

LSID urn:lsid:zoobank.org:act:14954B44-3454-4904-867C-BF61EFF7A5A2.

Etymology: From the Latin *phox* (=acute) and *rostus* (=rostrum), referring to the acute rostrum. The name is masculine in gender.

Type species: *Phoxirostus longicarpus* sp. nov.

Diagnosis—Body subcylindrical. Rostrum acute; eye large. Antenna 1 longer than antenna 2, anterior margin of peduncular article 1 not enlarged, or lobate. Mandible palp well-developed; incisor dentate; lacinia mobilis asymmetrical; molar well-developed, triturating. Maxilla 1 palp 2-articulate, bearing terminal articulating teeth; outer plate with 10–11 spine-teeth; inner plate broadly rounded, with two setae. Coxae 1–7 broader than long, overlapping; coxae 5–6 bilobate. Gills present from gnathopod 2 to pereopod 6. Gnathopods 1 and 2 similar, simple or weakly subchelate; carpus longer than propodus. Basis gradually expanded and merus gradually longer from pereopods 5 to 7. Pleonites 1–3 (or 2–3) carinate dorsomedially. Urosomites 1 and 3 longer than urosomite 2, the former saddled. Urosomite 3 elongate, more than twice as long as urosomite 2. Telson subsquare, entire, broader than long.

Notes—The family Laphystiopsidae Stebbing, 1899 are closely allied to the family Maxillipiidae Ledoyer, 1973 in having similar coxal shapes, the bulging ocular regions, the feeble maxillae, maxillipeds and gnathopods 1 and 2, the huge oostegites and the weak telson [5,12,13]. Maxillipiidae are distinguished by the enormously elongate pereopod 6 [5]. Unfortunately, the pereopods 6 of both present two new species are damaged. *Phoxirostus* gen. nov. is tentatively categorized under the family Laphystiopsidae Stebbing, 1899, primarily because of its saddle-shaped urosomite 1 (Barnard 1999).

Phoxirostus gen. nov. differs from all three genera currently belonging to Laphystiopsidae by the presence of acute rostrum, the outer plate of maxilla 1 bearing 10–11 spines, and the elongated carpus of pereopods 3 and 4. Additionally, *Phoxirostus* gen. nov. differs from *Prolaphystius* by the presence of a rostrum, coxa 4 much wider than long, the elongated carpus of pereopods 4, the pleonite 3 not having posterior projecting, and a telson wider than long. Actually, the classification of the genus Prolaphystius under Laphystiopsidae is debatable due to its lack of a rostrum and inner plate of the lower lip, the excavate coxa 4 and the elongate carpus of pereopod 3 [5]. However, it's challenging to categorize *Prolaphystius* under other families because of the reduced number of spines on the outer plate of maxilla 1 [5]. Therefore, we propose to tentatively include *Phoxirostus* gen. nov. within the Laphystiopsidae [5]. Hence, we would like to propose to temporarily place *Phoxirostus* gen. nov. in the Laphystiopsidae. *Phoxirostus* gen. nov. can be distinguished from *Laphystiopsis* and *Prolaphystiopsis* by the acute rostrum not reaching to distal end of first peduncular article, rather than very broad rostrum exceeding first peduncular article. Furthermore, *Phoxirostus* gen. nov. differs from *Laphystiopsis* by the palp of maxilla 1 biarticulated, and from *Prolaphystiopsis* by the first peduncular article of antenna 1 not grossly lobate.

Key to species of *Phoxirostus* gen. nov.

1. Eyes rounded; pleonite 1 without posterodorsal acute protrusion and posterior margin of pleonites 1 and 2 only with one acute protrusion medially

P. yapensis sp. nov.

-. Eyes reniform; pleonite 1 with posterodorsal acute protrusions and posterior margin of pleonites 1 and 2 with three acute protrusions

P. longicarpus sp. nov.

***Phoxirostus longicarpus* sp. nov. Figures 1–4.**

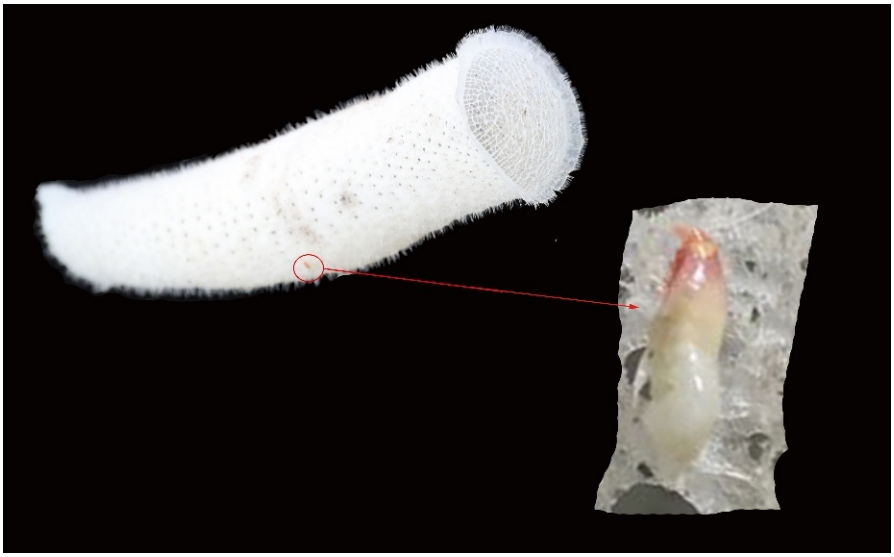

Figure 1. *Phoxirostus longicarpus* **sp. nov.**, MBM 286818, holotype, female (6.0 mm): showing that it is associated with the sponge and photographed after being fixed in 95% ethanol.

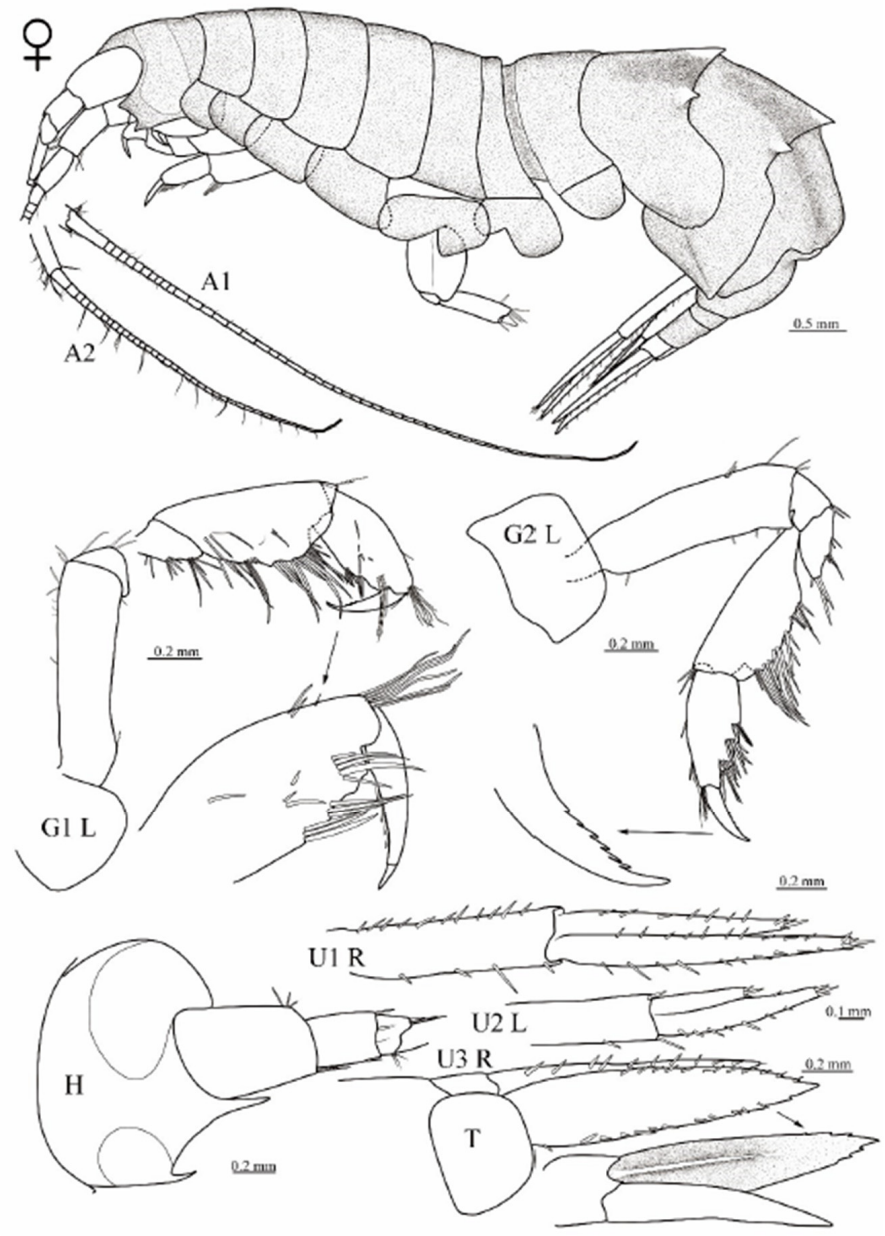

Figure 2. *Phoxirostus longicarpus* **sp. nov.**, MBM 286818, holotype, female (6.0 mm): A1, antenna 1; A2, antenna 2; G1 L, left gnathopod 1; G2 L, left gnathopod 2; H, head, U1 R, right uropod1; U2 L, left uropod 2; U3 R, right uropod 3, and the arrow points to the ventral view of inner ramus; T, telson.

LSID urn:lsid:zoobank.org:act:120C4556-5B37-48F6-B396-CB2D599AABB4.

Etymology: From the Latin "*long*" (=long) and "*carpus*" (=carpus), which is in reference to the elongated carpus of pereopods 4, 5, and 7 in the new species.

Holotype—NW Pacific, unnamed seamount in Caroline Plate, female 6.0 mm, dissected, M5006, 10°4′ N 140°12′ E, depth 1087 m, and 27 May 2019 (MBM 286818, DNA was extracted from another specimen with same collected information as holotype).

Description—Body subcylindrical; pleonites 1–3 carinate; pleonites 1 and 2 with posterodorsal acute protrusion, and posterior margin each side with one acute protrusion medially; epimeron 1 posteroventral corner with two small teeth, epimeron 2 posteroventral corner acute; urosomite 1 saddled. The rostrum present, acute, reaching to half-length of peduncular article 1 of antenna 1; eyes reniform, bulging laterally. Antenna 1 with articles 1 longest; accessory flagellum absent; flagellum with article 1 subequal to peduncular

article 2 and 3 combined, more than 50 articles. Antenna 2 with peduncular article 4 length subequal to article 5; flagellum with more than 40 articles.

Upper lip broader than long, distal margin bilobate medially. Lower lip with inner lobes. Mandible with left incisor with 9 unequal sized teeth, lacinia with 6 teeth; 5 strong accessory spines present; molar well-developed, triturating; palp well-developed 3-articulate, article 1 shortest, article 2 much broader than article 3, article 3 bearing 9 marginal and apical robust setae. Maxilla 1 with inner plate broadly rounded, bearing two apical setae; outer plate with eleven spine-teeth in two rows; palp biarticulate, with 7 apical spine-teeth. Maxilla 2 with distal long setae in both plates. Maxilliped with inner plate triangular, acute, hardly reaching to distal margin of palp article 1; outer plate rounded, with terminal setae, palp 4-articulate, four articles subequal in length.

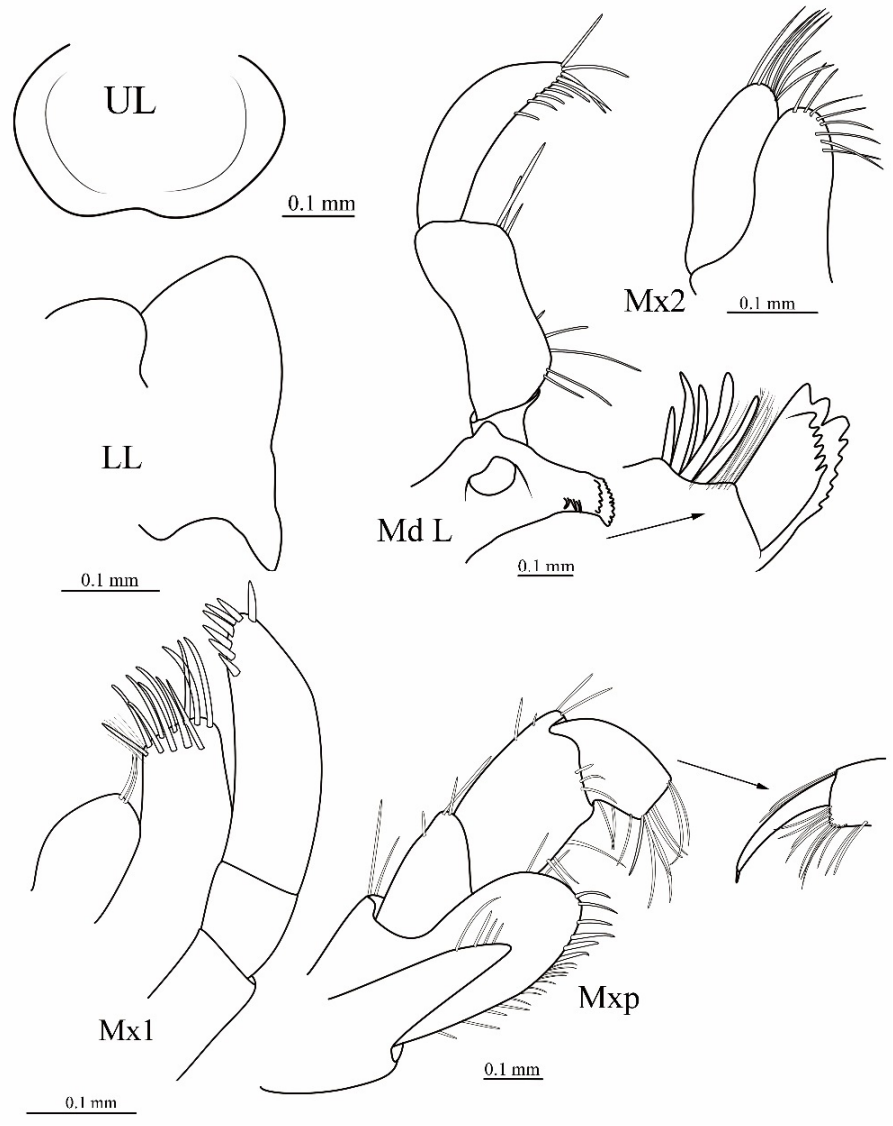

Figure 3. *Phoxirostus longicarpus* **sp. nov.**, MBM 286818, holotype, female (6.0 mm): UL, upper lip; LL, lower lip; Md L, left mandible; Mx1, maxilla 1; Mx2, maxilla 2; Mxp, maxilliped.

Gills present on coxae 2–6. Oostegites present on coxae 2–5, huge on coxa 2–4, small on coxa 5.

Gnathopod 1 weakly subchelate; coxa 1 subrectangular; merus subtriangular, posterior margin with three rows of robust setae; carpus longer than propodus, posterior margin with rows of long setae; propodus gradually narrower distally, posterior margin with about three rows of robust setae; dactylus simple, tapering, half-length of propodus, posterior margin

spinose. Gnathopod 2 simple; coxa 2 subrectangular; merus, carpus and dactylus similar to that of gnathopod 1; palm acute. Pereopod 4 with coxa subrectangular, posterior margin excavate; basis linear; ischium small; merus slightly expanded distally; carpus subequal in length to merus; propodus longer than carpus, posterior margin with small robust setae; dactylus about 2/3 length of propodus. Pereopod 5 with coxa bilobate, anterior lobe larger than posterior lobe; basis weakly expanded, with rounded posterodistal lobe; merus and carpus subequal in length, anterior margins with small robust setae; propodus longer than carpus, anterior and posterior margin with small robust setae; dactylus about 2/3 length of propodus. Pereopod 6 with coxa bilobate, anterior lobe smaller than posterior lobe; basis more expanded than that of pereopod 5, with rounded posterodistal lobe, anterior and posterior margin of merus with small robust setae; distal three articles missing. Pereopod 7 much longer than pereopod 5, with coxa unilobate; basis extremely expanded, with rounded posterodistal lobe; dactylus about 1/2 length of propodus.

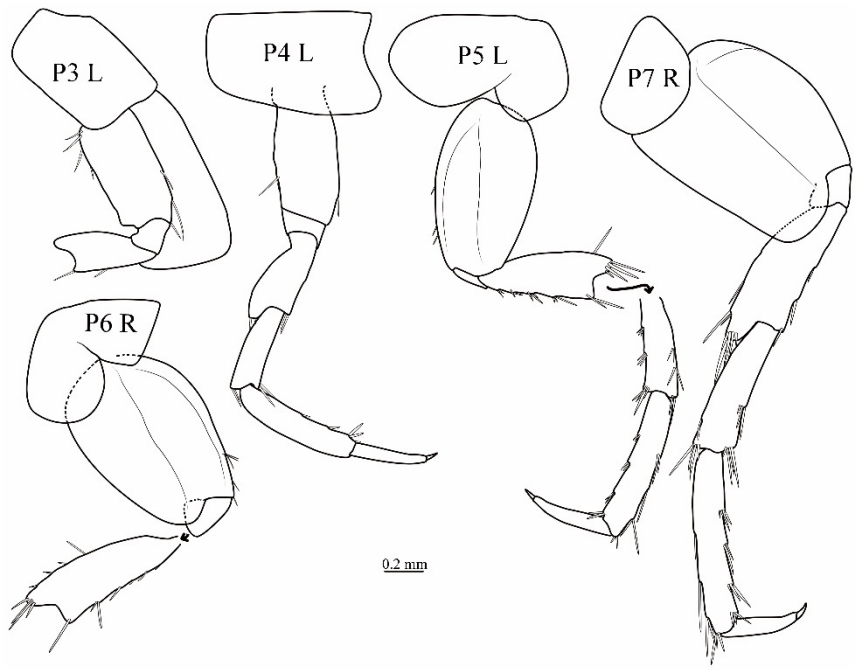

Figure 4. *Phoxirostus longicarpus* **sp. nov.**, MBM 286818, holotype, female (6.0 mm): P3 L, left pereopod 3; P4 L, left pereopod 4; P5 L, left pereopod 5; P6 R, right pereopod 6; P7 R, right pereopod 7.

Uropod 1 peduncle subequal in length to outer ramus, margins with small robust setae; outer ramus shorter than inner one, margins and tip apical of rami with small robust setae. Uropod 2 shorter than uropods 1 and 3, peduncle subequal in length to inner ramus; outer ramus longer than inner ramus, margins and tip apical with robust setae; inner ramus only with apical robust setae. Uropod 3 peduncle small; outer ramus slightly shorter than inner one, margins of rami with robust setae; inner ramus serrate subdistally and keeled ventrally. Telson entire, subrectangular.

Notes—morphologically, *Phoxirostus longicarpus* sp. nov. differs from *P. yapensis* sp. nov. by the following characteristics: reniform eyes; coxa 4 slightly excavated posteriorly, while it is rounded in *P. yapensis* sp. nov.; and the presence of acute protrusions on the posterior margin of pleonite 1 and bearing three acute protrusions on the posterior margin of pleonite 2.

Laphystiopsids have been observed to make surficial burrows on crinoids [5]. *Phoxirostus longicarpus* sp. nov. is the first laphystiopsid that have been reported to be associated with sponges (Figure 1).

***Phoxirostus yapensis* sp. nov. Figures 5–8.**

Figure 5. *Phoxirostus yapensis* **sp. nov.**, MBM 286617, holotype, female (7.1 mm): photographed immediately after being collected by Wei Jiang.

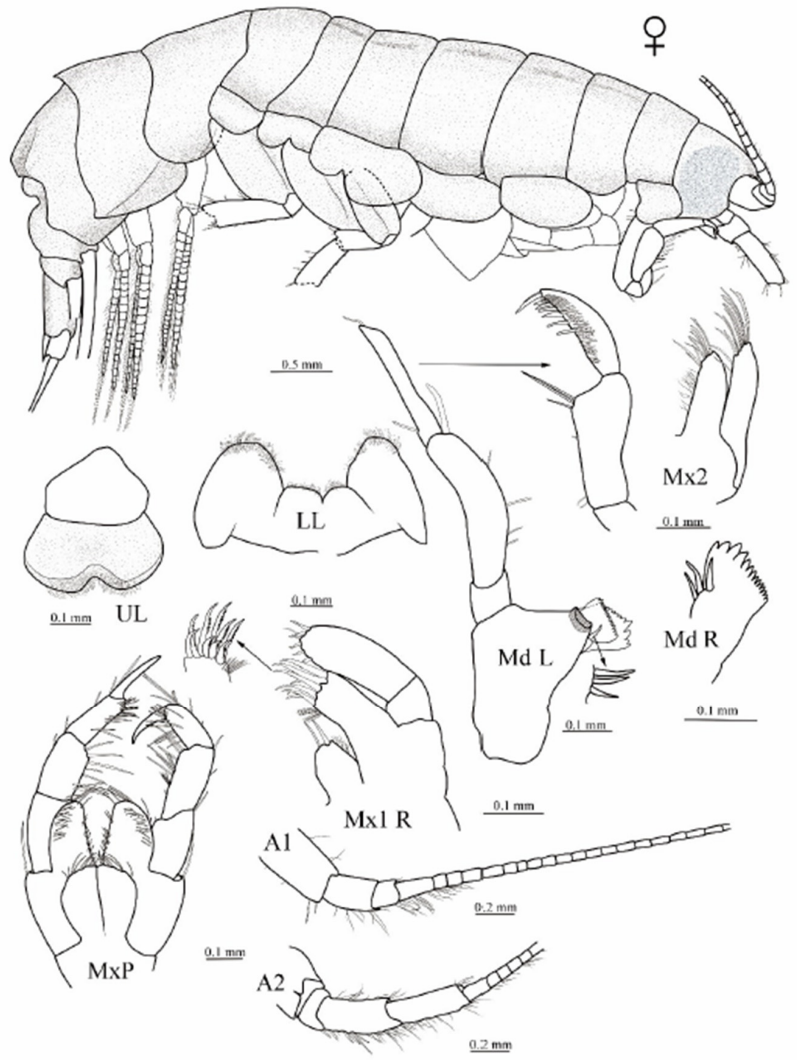

Figure 6. *Phoxirostus yapensis* **sp. nov.**, MBM 286617, holotype, female (7.1 mm): UL, upper lip; LL, lower lip; Md L, left mandible, and the arrow points to details of two distal articles of palp; Md R, only shows the incisor and accessory spines; Mx1 R, right maxilla 1; Mx2, maxilla 2; Mxp, maxilliped; A1, antenna 1; A2, antenna 2.

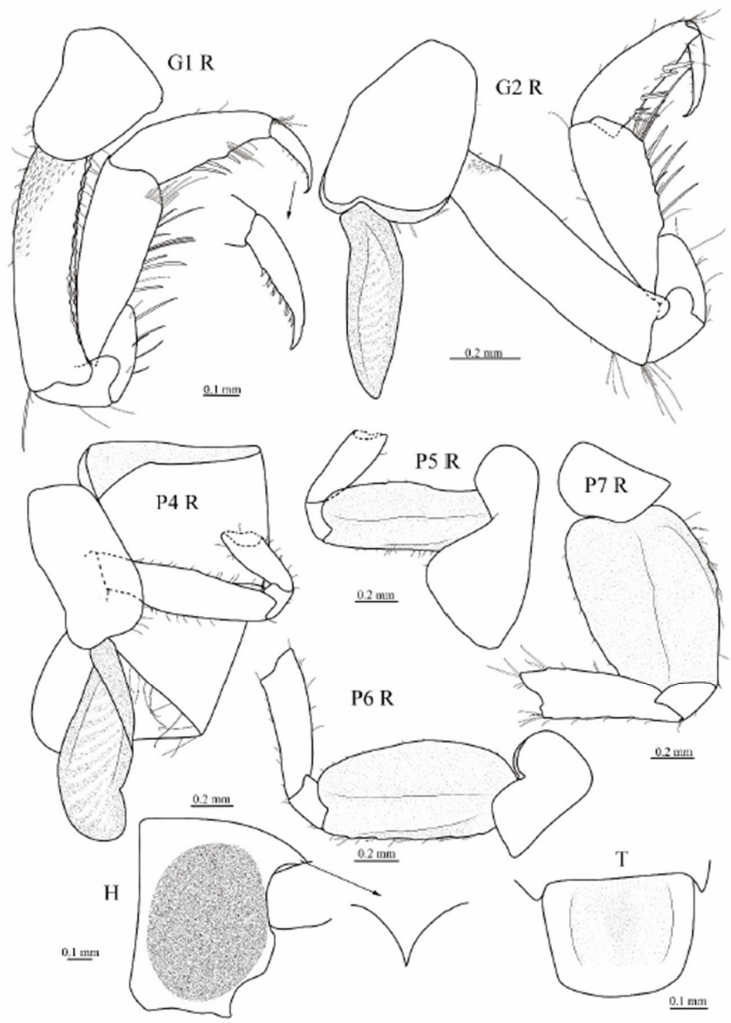

Figure 7. *Phoxirostus yapensis* **sp. nov.**, MBM 286617, holotype, female (7.1 mm): G1 R, right gnathopod 1; G2 R, right gnathopod 2; P4 R, right pereopod 4; P5 R, right pereopod 5; P6 R, right pereopod 6; P7 R, right pereopod 7; H, head, arrow points acute rostrum; T, telson.

LSID urn:lsid:zoobank.org:act:66FD27DA-8E1D-4816-9174-D397E0885EBD.

Etymology: In reference to its type locality Yap seamount.

Holotype—NW Pacific, Yap Seamount, female 7.1 mm, dissected, Y30041, St. FX-DIVE-16, 8°52′ N 137°44′ E, foraminiferal ooze, depth 813–1130 m, 15 December 2014 (MBM 286617). Paratype—NW Pacific, Yap Seamount, male 5.3 mm, Y30041, St. FX-DIVE-16, 8°52′ N 137°44′ E, foraminiferal ooze, depth 813–1130 m, 15 December 2014 (MBM 286617).

Description—Body subcylindrical; pleonites 2 and 3 carinate, and pleonite 2 with acute protrusion posterodorsally; epimeron 2 posteroventral corner subacute; urosomite1 saddled. Rostrum present, acute, reaching to 1/3 length of peduncular article 1 of antenna 1; eyes bulging laterally, nearly as large as head. Antenna 1 with peduncle short, peduncular articles 1–3 in length ratio of 1:0.6:0.4, article 1 longer than broad; accessory flagellum absent; flagellum with article 1 much longer than peduncular article 3, margins only bearing simple setae. Antenna 2 with peduncular article 4 subequal to article 5 in length, ventral margin bearing robust setae.

The upper lip broader than long, distal margin bilobate ventrally, bearing dense setae. Lower lip with outer lobes rounded distally with poorly developed mandibular processes; inner lobes much shorter than outer lobes. Mandible asymmetrical, left mandible incisor with fifteen unequal sized teeth, lacinia mobilis with seventeen teeth, 3 strong accessory spines; right incisor with fourteen unequal sized teeth, 3 strong accessory spines; molar well-developed, triturating; palp well-developed, 3-articulate, article 1 shortest, article 2

much broader than article 3, bearing three long setae, article 3 bearing 6 marginal and two apical robust setae, medial surface bearing dense setae. Maxilla 1 with inner plate broadly rounded, bearing two apical setae; outer plate with 5 long and 5 short spine-teeth in two rows; palp 2-articulate. Maxilla 2 with distal long setae in both plates. Maxilliped with inner plate subrectangular, hardly reaching to base of outer plate, distal margin bearing 7–8 setae; outer plate slightly overreaching distal margin of palp article 1, with 5 long terminal setae, 5 pairs of medial marginal and several lateral marginal setae; palp 4-articulate, four articles subequal in length, article 2 longer than broad, not expanded, dactylus falcate.

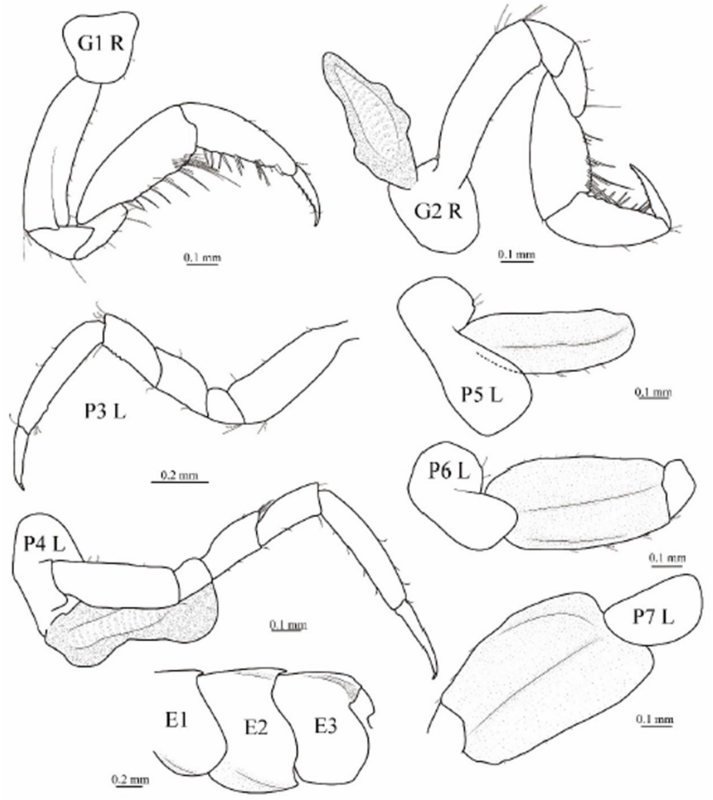

Figure 8. *Phoxirostus yapensis* **sp. nov.**, MBM 286617, paratype, male (5.3 mm): G1 R, right gnathopod 1; G2 R, right gnathopod 2; P3 L, left pereopod 3; P4 L, left pereopod 4; P5 L, left pereopod 5; P6 L, left pereopod 6; P7 L, left pereopod 7; E1–3, epimeron plates 1–3.

Coxae 1–4 broader than long, overlapping. Gills present on coxae 2–6. Oostegites present on coxae 2–5, huge on coxa 2–4, small on coxa 5.

Gnathopod 1 simple; coxa subtriangular; basis with rounded anterodistal lobe; ischium short, nearly as long as merus, with anterodistal rounded lobe; carpus 4/5 length of basis, posterior margin with long setae, and row of sub-terminal setae; propodus shorter than carpus and narrower, gradually narrower distally, palm acute, with 4 robust setae along margin; dactylus simple, tapering, half-length of propodus, posterior margin spinose. Gnathopod 2 slightly longer than and similar to gnathopod 1, simple; coxa subrectangular; basis and ischium with rounded anterodistal lobe; carpus shorter than basis, distally slightly expanded, posterior margin bearing 8 long and sub-terminal clump of setae; propodus shorter than carpus, posterior margin bearing 7 robust setae; palm acute; dactylus longer than half-length of propodus, posterior margin spinose. Pereopod 4 with coxa subrectangular, twice broader than long, posterior margin slightly excavate; basis linear; ischium small; merus slightly expanded distally, distal three articles missing. Pereopod 5 with coxa bilobate, anterior lobe larger than posterior lobe; basis weakly expanded, with rounded posterodistal lobe; ischium and merus longer than that of pereopod 4; distal three articles missing. Pereopod 6 with coxa bilobate, anterior lobe smaller than posterior

lobe; basis expanded, slightly longer than that of pereopod 5, with rounded posterodistal lobe; carpus longer than that of pereopod 5; distal three articles missing. Pereopod 7 with coxa unilobate, not much smaller than coxa 6; basis extremely expanded, with rounded posterodistal lobe; carpus slightly longer and broader than that of pereopod 6; distal three articles missing.

Uropods 1–3 broken, peduncle of uropod 3 much shorter than rami. Telson about 1.2 times broader than long, medial surface concave.

3.2. Phylogenetic Analyses

The phylogenetic trees produced by BI and ML analyses were not strongly congruent (Figure 9). However, the family Laphystiopsidae was clustered with Acanthonotozomatidae in both ML and BI trees with moderate support (BP = 81% and PP = 0.75). Moreover, the families Epimeriidae and Stilipedidae were shown as not monophyly. The stilipedid species *Alexandrella dentata* formed a clade with two epimeriid species (*Epimeria cornigera* and *E. loricata*) and a dikwid species (*Dikwa andresi* Lorz and Coleman, 2003) both in ML and BI trees, even with low BP (<50%) and PP (<0.75). The remaining epimeriid species were clustered with a stilipedid species (*Astyra abyssi*) and the iphimediid and vicmusiid species both in ML and BI trees.

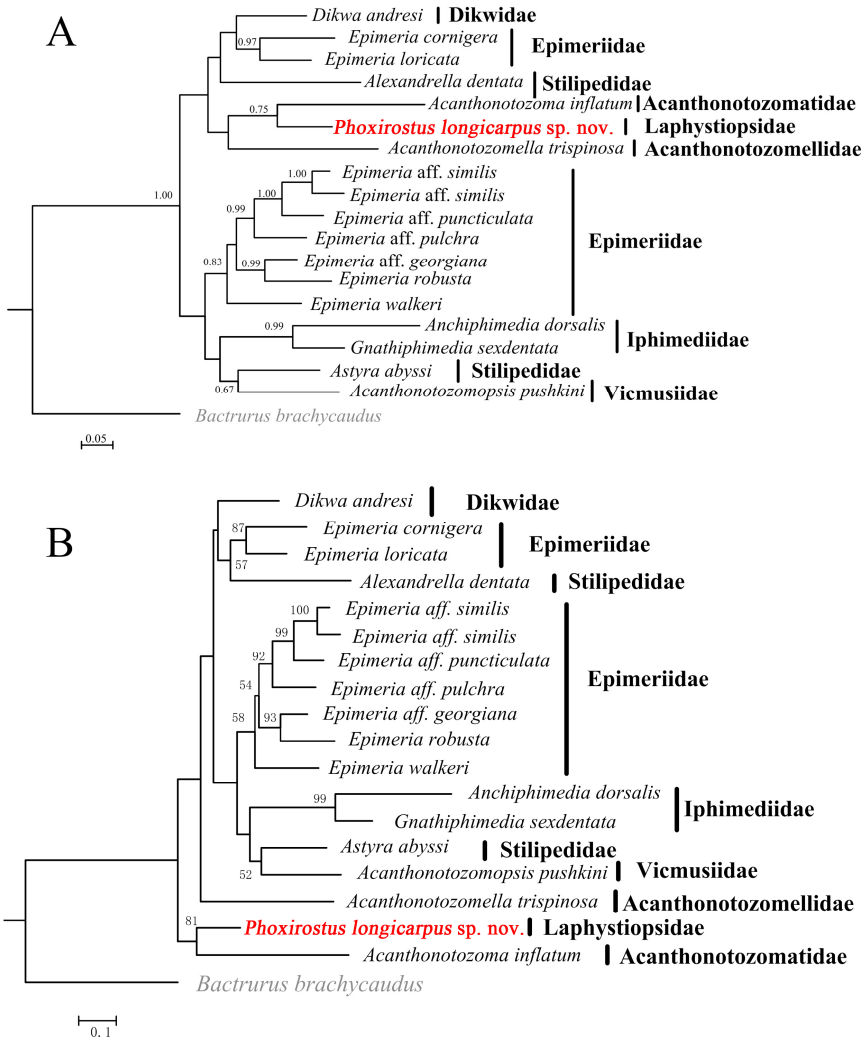

Figure 9. Phylogenetic tree of the superfamily Iphimedioidea Boeck, 1871, taxa resolved based on the combined dataset of four genes (COI and H3): (**A**) Bayesian inference (BI) tree; (**B**) maximum likelihood tree.

4. Discussion

The Laphystiopsidae family currently contains eight species within three genera, which are distributed across the globe (Figure 10). Among them, five *Laphystiopsis* species are spread across the Atlantic, Pacific, and Indian Oceans, while two *Prolaphystiopsis* species are found in the Pacific and Indian Oceans [3–5]. The monotypic genus *Prolaphystius* is exclusive to the Antarctic Ocean [2]. Including the present two new species, six species within three genera have been reported in the Western Pacific Ocean, and two species within two genera in the Atlantic Ocean. The Indian and Antarctic Oceans have only reported one species each. Similar to the deep-sea Ophiurus (Echinodermata) species, which has the highest diversity in the Western Pacific [14], the Western Pacific also has the highest species richness of amphipod Laphystiopsidae species. This suggests that the Western Pacific may possess the highest biodiversity in the world deep sea.

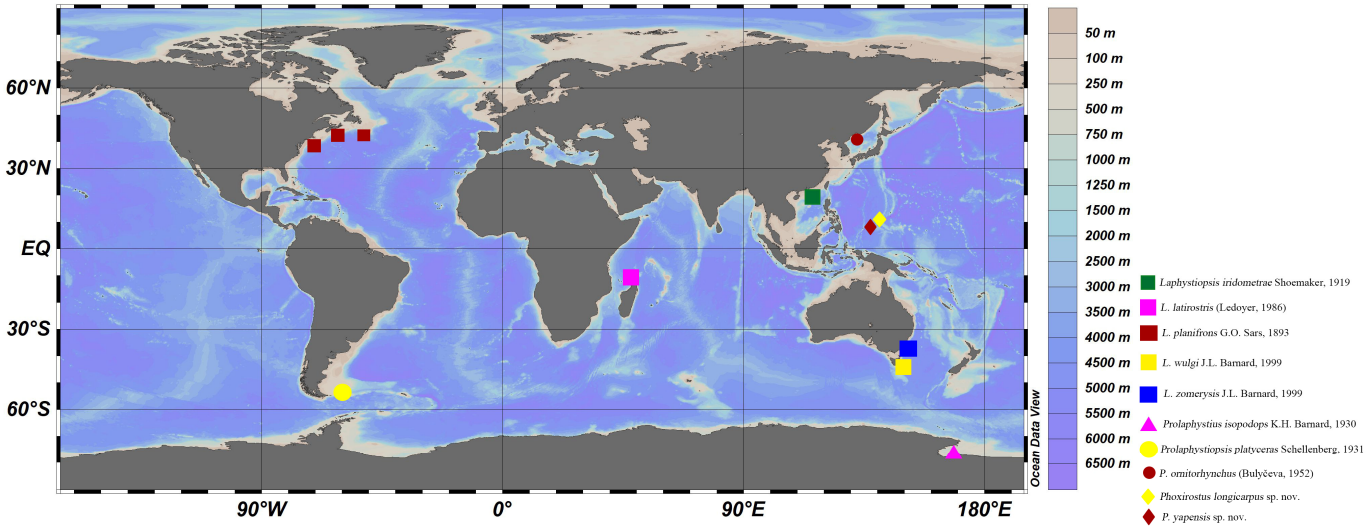

Figure 10. The distribution of laphystiopsid species: the location of the sampling site of two new species (red and yellow rhombus); distribution of *Laphystiopsis* species (green, pink, red, yellow, and blue square); distribution of *Prolaphystius* species (pink triangle) and Prolaphystiopsis species (red and yellow circle).

Morphological classifications had previously assigned Laphystiopsidae to the Iphimedioidea superfamily [15]. However, the molecular phylogenetic analysis conducted by Copilaş-Ciocianu et al. [16] indicates that the monophyly of the Iphimedioidea superfamily is not supported and that it forms a clade with the superfamily Eusiroidea. Additionally, our study finds that the Epimeriidae and Stilipedidae families are not monophyletic, aligning with the findings of Verheye et al. [17]. Therefore, our research highlights the need for further sampling of taxa and molecular data to clarify the phylogenetic relationships between the Iphimedioidea and Eusiroidea superfamilies.

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