

## A new landhopper genus and species (Crustacea: Amphipoda: Talitridae) from Annamite Range, Vietnam

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**Abstract.** A new talitrid genus *Solitroides* is erected along with a description of a new species, *Solitroides motokawai*, from the Annamite Range, Vietnam. *Solitroides motokawai*, new genus & species, possesses the simplidactylate pereopods 3–7: this is the first record of simplidactylate landhoppers from the Northern Hemisphere. The simplidactylate *Solitroides motokawai*, new genus & species, is diagnosed by the following combination of characters: innermost apical robust seta on outer plate of maxilla 1 leaning inwards; arcuate outer plate of maxilliped; slender maxilliped palp without lobes, its article 4 coalescing with article 3; oblique palmar margin of propodus on gnathopod 1 in female; large and folded coxal gill 6; apically setose oostegite 5; marginally bare peduncles of pleopods 1–2, and shortest pleopod 3 with minute simple setae on its inner and outer margins, each pleopod with developed rami; and rhombic telson with slightly cleft apical part. Additionally, nucleotide sequences of nuclear 28S ribosomal RNA and histone H3 as well as mitochondrial cytochrome *c* oxidase subunit I and 16S ribosomal RNA from the holotype and paratype were determined. A key to the talitrid species recorded from Vietnam is provided.

**Key words.** Talitroidea, simplidactylate, monospecific genus, mountainous

### INTRODUCTION

The family Talitridae contains amphipods inhabiting supralittoral to terrestrial habitats, and this family currently consists of 74 genera (Lowry et al., 2016). The talitrid amphipods have been divided into four informal groups on systematic-ecological bases (Bousfield, 1982, 1984): palustral talitrids indigenous especially to estuarine habitats; beach fleas occurring in supralittoral and coastal rain forest habitats; sand hoppers specialising in fossorial, indigenous to supralittoral habitats on sandy beaches; and landhoppers consisting of truly terrestrial species distributed in coastal continental regions as well as high-island rain forests. Whereas, Wildish (2012) proposed another ecological grouping: terrestrial talitrids (landhoppers), wrack generalists, and substratum specialists, which are composed of three subgroups, sand burrowers, troglobionts and driftwood talitrids (see Wildish et al., 2012).

At the same time, the previous works have tried to define morphological subdivisions for highly-diversified talitrid amphipods. Bousfield (1982) defined the character states of the dactyli of pereopods 3–7: simplidactylus lacking cusps on the pereopodous dactyli; and cuspidactylus having cusp(s) on the pereopodous dactyli. Later Miyamoto & Morino (2012) refined the character states of cuspidactylus as uni-cuspi, bearing single cusp, and bi-cuspi, with two cusps on the dactyli. Major subdivisions based on characters different from the pereopodous dactyli are also attempted by other authors, thus Lowry & Coleman (2012) designated two subgroups for the talitrid genera on the basis of the characteristics of male gnathopod 2: *Talitrus*-group defined by the undeveloped, mitten-shaped gnathopod 2, and *Orchestia*-group by the developed massive gnathopod 2. Monophyly of these morphological subgroups needs to be assessed with the molecular phylogenetic analyses based on the full-range of the known talitrid species (Lowry & Coleman, 2012).

The species diversity of the landhoppers, sensu Bousfield (1982, 1984), inhabiting Southeast Asia remains far from clarified. Most of talitrid species recorded from terrestrial habitats in this region belong to cuspidactylate beach-flea genera, *Floresorchestia* Bousfield, 1984 and *Platorchestia* Bousfield, 1982 (Dang & Le, 2011; Lowry & Springthorpe, 2015a; Wongkamhaeng et al., 2016); only three landhopper species have been described from the region: *Curiotalitrus curioi* (Javier & Coleman, 2010) and “*Parorchestia*” *luzonensis* Baker, 1915 from Philippine Islands; and “*P.*” *kinabaluensis* Shoemaker, 1935 from Borneo Island. These landhoppers are assigned to the cuspidactylate species (Baker, 1915; Shoemaker, 1935; Bousfield, 1984; Javier

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& Coleman, 2010). In addition to the three species, one cosmopolitan landhopper species, *Talitroides topitotum* (Burt, 1934) has been recorded from Vietnam (Morino, 2013) and Indonesia (Daneliya & Wowor, 2016). This species is also cuspidactylate, and is believed to have dispersed via human activities (Morino, 2013; do Nascimento & Serejo, 2016).

Recently, landhopper amphipods were collected from high mountainous sites of Ngoc Linh in the Annamite Range, Vietnam. The morphological examination of the talitrids revealed that they are assigned to the simplidactylate group and possess several peculiar features, so that a new genus and species for the simplidactylate talitrid from Vietnam are described. Additionally, nucleotide sequences of nuclear and mitochondrial markers from the specimens are determined for future phylogenetic studies.

## MATERIAL AND METHODS

**Sampling and morphological examination.** Landhoppers were collected from the Ngoc Linh Nature Reserve, Kon Tum Province, Vietnam. Elevation and geographical coordinates for localities were obtained using a Garmin eTrex® GPS unit. Samples were immediately fixed and preserved in 99% ethanol in the field. For DNA extraction, muscle tissue was removed from the dorsal side of the pleon of each of two specimens in the laboratory.

All appendages of the examined specimens were dissected in 70% ethanol and mounted in gum-chloral medium on glass slides under a stereomicroscope (Olympus SZ61). The specimens were examined using a light microscope (Olympus BH2) and illustrated with the aid of a camera lucida. The body length from the tip of the rostrum to the base of the telson was measured along the dorsal curvature to the nearest 0.1 mm. The specimens have been deposited in the Zoological Collection of Kyoto University (KUZ) and in the biological collection of the Vietnam National Museum of Nature (VNMN).

Since no male specimen has been obtained, the taxonomic description is provided based on females. Additionally, some setae of a holotype of the present new species are broken off; those broken setae are shown as setal traces in the figures.

**Scanning electron microscopy (SEM).** A maxilliped of one specimen, KUZ Z1865, of the present landhopper species was removed and dehydrated through a graded ethanol series, and dried using hexamethyldisilazane (HMDS) (Nation, 1983). Then, the maxilliped was sputter-coated with gold, and observed using a scanning electron microscope (JCM-6000 NeoScope).

**PCR and DNA sequencing.** The extraction of genomic DNA from pleon muscle followed Tomikawa et al. (2014). Primer sets for the PCR and cycles sequencing (CS) reactions used for 28S rRNA (28S), histone H3 (H3), and cytochrome *c* oxidase subunit I (COI) were shown in Tomikawa et al. (2016a), and that for 16S rRNA (16S) was in Tomikawa et al. (2016b).

The PCR reaction and DNA sequencing were performed using the modified methods mentioned in Nakano (2012) and Tomikawa et al. (2016a). The PCR mixtures were heated to 94°C for 5 min, followed by 35 cycles at 94°C (10 s each), 50°C (20 s each), and 72°C (1 min 24 s for 28S, 24 s for H3, 42 s for COI, or 30 s for 16S), and a final extension at 72°C for 6 min. The sequencing mixtures were heated to 96°C for 2 min, followed by 40 cycles at 96°C (10 s each), 50°C (5 s each) and 60°C (54 s each). The obtained sequences were edited using DNA BASER (Heracle Biosoft S.R.L.). The DNA sequences newly obtained in this study were deposited with the International Nucleotide Sequence Database Collaboration through the DNA Data Bank of Japan.

## TAXONOMY

### Family Talitridae Rafinesque, 1815

#### Genus *Solitroides*, new genus

**Type species.** *Solitroides motokawai*, new species, by present designation.

**Diagnosis (female).** Body size medium. Eyes medium. Antenna 1 reaching distal part of peduncular article 4 of antenna 2; peduncle longer than flagellum, articles 1 and 2 subequal in length, article 3 longest. Antenna 2 with flagellum subequal to peduncle in length. Maxilla 1, innermost apical robust seta on outer plate leaning inwards. Mandible, left lacinia mobilis four-dentate, right lacinia mobilis bifid, bearing two and three teeth. Maxilliped outer plate arcuate, apically rounded with submarginal setae; palp slender, medial lobes of articles 2 and 3 undeveloped, article 4 coalescing with article 3.

Gnathopod 1 unguiform; basis to propodus without lobe, palmar margin oblique, with robust setae, dactylus approximately twice as long as palmar margin. Gnathopod 2; basis slender, ischium and merus without lobe, carpus with lobe, propodus mitten-shaped, posterior lobe developed, palmar margin parallel to anterior margin. Pereopods 3–7 simplidactylate, locking robust setae on propodi lacking, dactyli elongate and slender, nail subequal to base. Coxa of pereopod 4 wider than deep. Coxa of pereopod 6, anterodistal corner of posterior lobe quadrate with setae. Coxal gills of gnathopod 2 and pereopod 6 largest, gill of gnathopod 2 lobed at middle, gill of pereopod 6 complex, folded, partly lobate; gills of pereopods 3–5 without lobe, distally attenuated. Oostegites small, each with 3–5 short and simple apical setae.

Epimeral plates without slits above ventral margins, posterodistal corners of plates 1 and 2 quadrate, that of plate 3 rounded. Pleopods 1–3 biramous, rami developed; peduncles of pleopods 1 and 2 without seta, inner and outer margins of peduncle of pleopod 3 with numerous minute simple setae. Uropod 1, peduncle with distolateral robust seta longer than subdistal seta; inner ramus with three robust setae marginally; outer ramus with bare margin. Uropod 2, inner ramus slightly longer than outer ramus, with three

robust setae marginally; outer ramus with bare margin. Uropod 3, peduncle with dorsal robust seta and a few small setae, ramus shorter than peduncle, with two apical setae. Telson rhombic, apical part slightly cleft, with one apical seta per lobe.

**Etymology.** The generic name is a compound noun derived from the Latin word, *solus* (alone), and the family specific suffix -tr-oidea (masculine), referring to the fact that the type species' known locality is isolated from the distributions of the other simplidactylate landhoppers.

***Solitroides motokawai*, new species**

(Figs. 1–7)

**Material examined.** Holotype: female (6.5 mm, VNMN 2017.01), Ngoc Linh Nature Reserve, Kon Tum Province, Vietnam (15°05'14.2"N, 107°51'19.6"E; elevation 1833 m), coll. T. Nakano, 20 September 2014. Paratypes: two females (10.5 mm, KUZ Z1865; 8.2 mm, KUZ Z1866) and one juvenile (3.1 mm, VNMN 2017.02), same data as holotype; four females (7.8 mm, KUZ Z1867; 6.9 mm, VNMN 2017.03; 6.4 mm, VNMN 2017.04; 7.9 mm, KUZ Z1868), near the type locality (15°05'14.1"N, 107°51'23.8"E; elevation 1771 m), coll. T. Nakano, 17 September 2014; and two females (8.1 mm, VNMN 2017.05; 6.8 mm, KUZ Z1869), near the type locality (15°05'02.7"N, 107°51'11.8"E; elevation 1986 m), coll. T. Nakano, 19 September 2014.

**Description of holotype (female, VNMN 2017.01; Fig. 1).**

Head (Fig. 2A) with short rostrum; antennal sinus shallow, rounded; eye oval, major axis  $0.5 \times$  height of head. Dorsal surface of pereonites and pleonites smooth. Posterodistal corners of epimeral plates 1 and 2 quadrate, of epimeral plate 3 rounded; posterior margins of epimeral plates 1–3 with seta, respectively; around posterodistal corners of epimeral plates 1 and 2 with seta, respectively (Fig. 5J–L).

Antenna 1 (Fig. 2B), reaching distal part of peduncular article 4 of antenna 2; peduncular articles 1–3 in length ratio of 1.0 : 0.9 : 1.2; posterodistal corners of peduncular articles 1–3 with one seta, one pair of setae, and one seta, respectively; flagellum six-articulate.

Antenna 2 (Fig. 2C), length  $0.4 \times$  body length; posterior margin of peduncular article 4 with one single seta and one pair of setae; posterior margin of peduncular article 5 with three pairs of setae, peduncular article 5 subequal in length to articles 3 and 4 combined; flagellum 12-articulate, subequal to peduncle in length.

Upper lip with rounded distal margin, bearing fine setae (Fig. 2D).

Mandible with left and right incisors five- and four-dentate, respectively (Fig. 2E, F); left lacinia mobilis four-dentate; right lacinia mobilis bifid, bearing two and three teeth; molar process triturative, with plumose seta.



Fig. 1. *Solitroides motokawai*, new genus & species, holotype (VNMN 2017.01), lateral view. Scale bar = 1 mm.

Lower lip with broad shoulder; inner lobes indistinct (Fig. 2G).

Maxilla 1 with inner and outer plates and palp (Fig. 2H); apical margin of inner plate with two plumose setae; outer plate with three serrate and six simple robust setae, innermost apical robust seta leaning inwards; palp one-articulate, minute.

Maxilla 2 (Fig. 2I), inner plate with one plumose seta on medial margin, row of nine setae and one plumose seta on apical margin; outer plate slightly longer than inner plate; outer plate with 10 simple and two plumose setae on apical margin.

Maxilliped (Fig. 3A); inner plate with 10 plumose and three robust setae on apical margin; outer plate arcuate, apically rounded, with one plumose seta and eight setae on subapical margin; palp three-articulate; inner margin and outer submarginal part of article 2 with two and one setae, respectively; article 3 subquadrate with setae; article 4 coalescing with article 3.

Gnathopod 1 (Fig. 3B), anterior to ventral margin of coxa with nine setae; anterior and posterior margins of basis with robust setae; carpus length  $2.4 \times$  width, posterior margin with six setae; propodus length  $0.6 \times$  length of carpus and  $1.8 \times$  width of propodus, palmar margin oblique, with robust setae; dactylus simple, length  $2.1 \times$  palmar margin, posterior and anterior margins each with seta.

Gnathopod 2 (Fig. 3C), ventral margin of coxa with nine setae; anterior margin of basis with three setae; carpus length  $2.0 \times$  width, posterodistal lobe developed, with scabrous surface; propodus length  $1.2 \times$  length of carpus and  $3.5 \times$  width of propodus, mitten-shaped, posterior lobe developed, with scabrous surface; palmar margin parallel to anterior margin; dactylus shorter than palmar margin.

Pereopods 3–7 simplidactylate, propodi lacking locking robust setae (Figs. 3D–4H). Pereopods 3 and 4 each with coxa wider than deep, its posterior cusp hooked (Figs. 3D, 4A). Pereopod 3 (Fig. 3D, E), dactylus length  $0.5 \times$  length of propodus. Pereopod 4 (Fig. 4A, B), length  $0.6 \times$  length

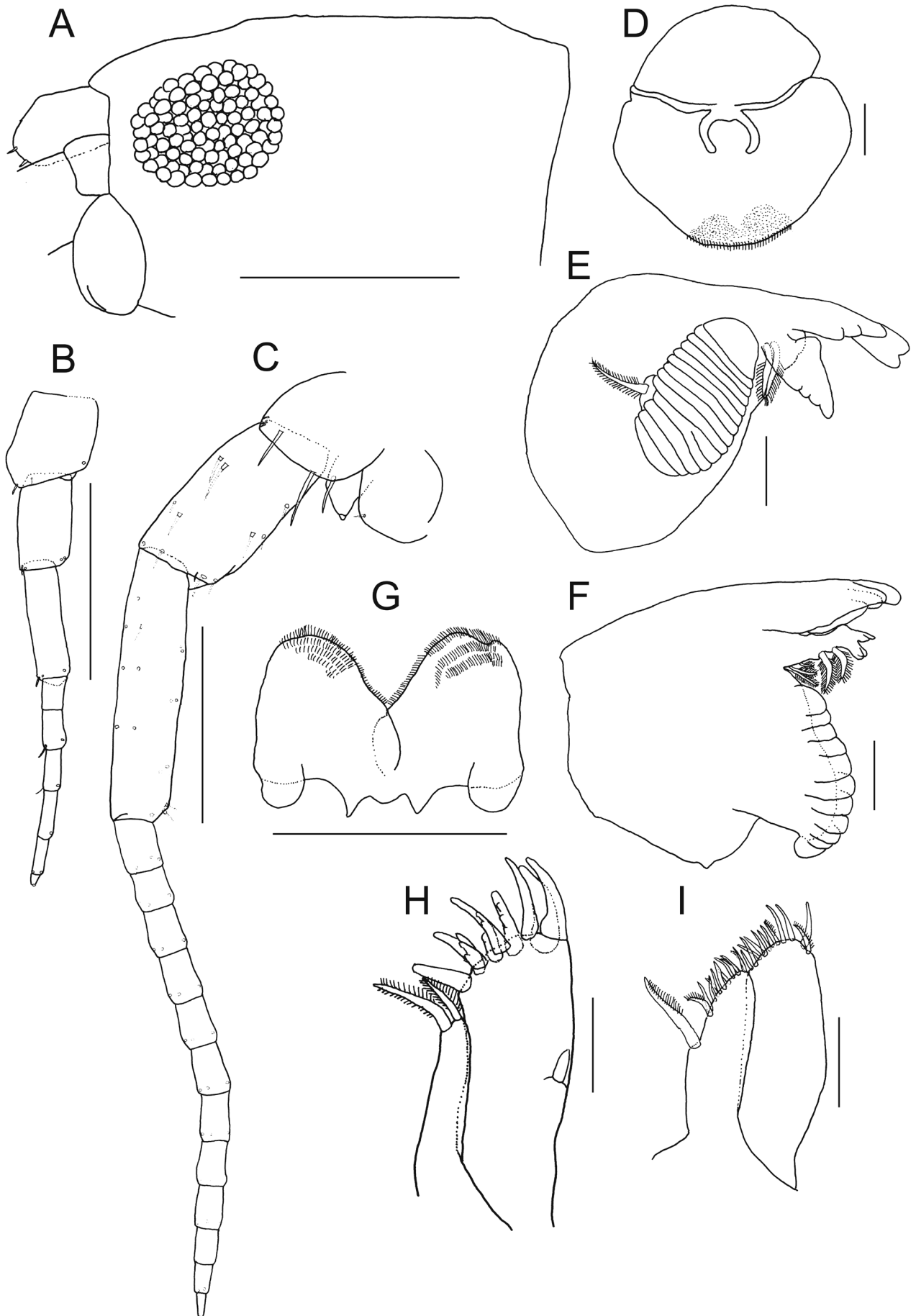


Fig. 2. *Solitroides motokawai*, new genus & species, holotype (VNMN 2017.01). A, head, lateral view; B, antenna 1, lateral view; C, antenna 2, lateral view; D, upper lip, anterior view; E, left mandible, medial view; F, right mandible, lateral view; G, lower lip, ventral view; H, maxilla 1, dorsal view; I, maxilla 2, dorsal view. Scale bars = 0.5 mm [A–C, G]; 0.1 mm [D–F, H, I].

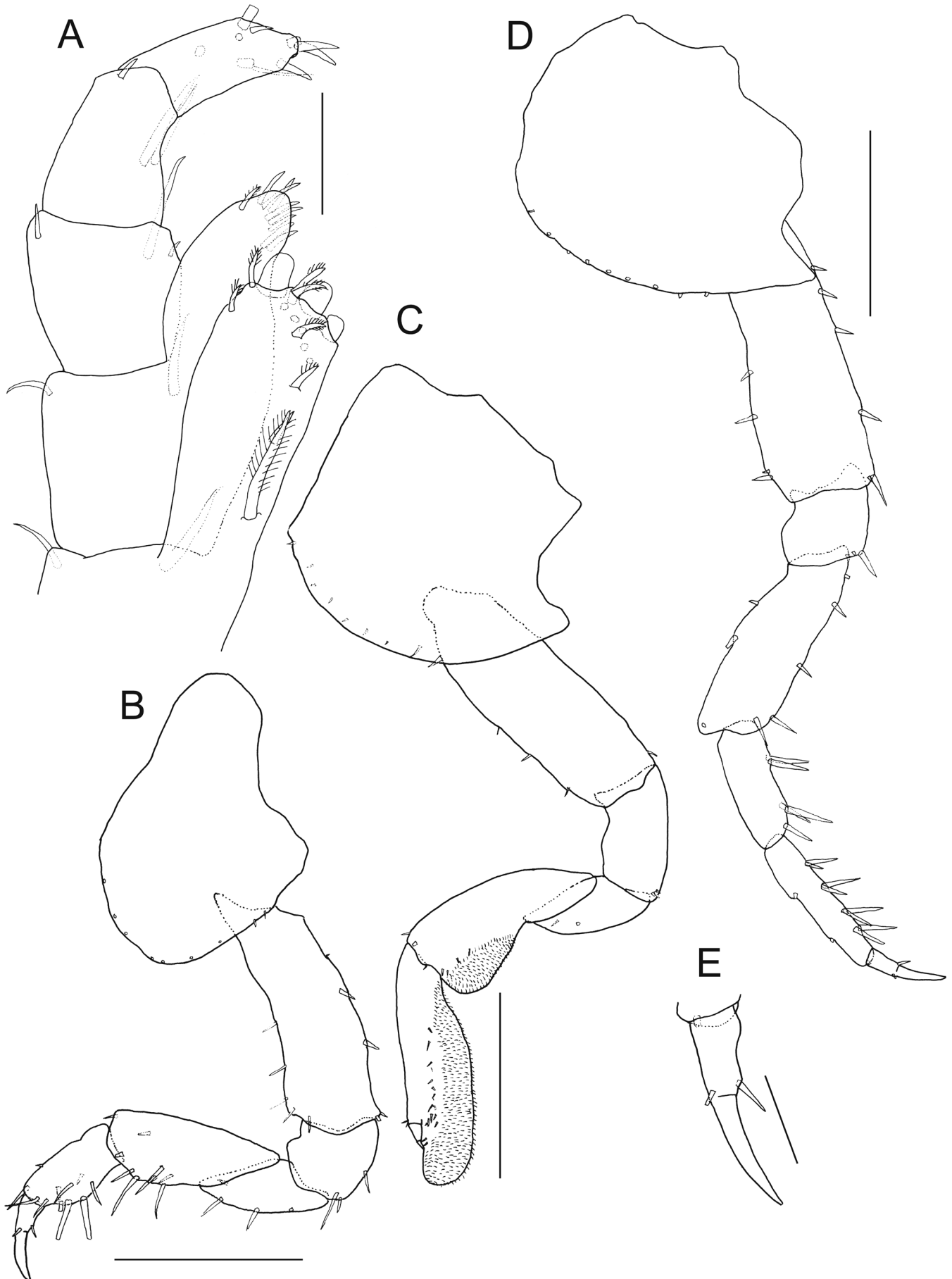


Fig. 3. *Solitroides motokawai*, new genus & species, holotype (VNMN 2017.01). A, maxilliped, dorsal view; B, gnathopod 1, lateral view; C, gnathopod 2, lateral view; D, pereopod 3, lateral view; E, dactylus of pereopod 3. Scale bars = 0.1 mm [A, E]; 0.5 mm [B–D].

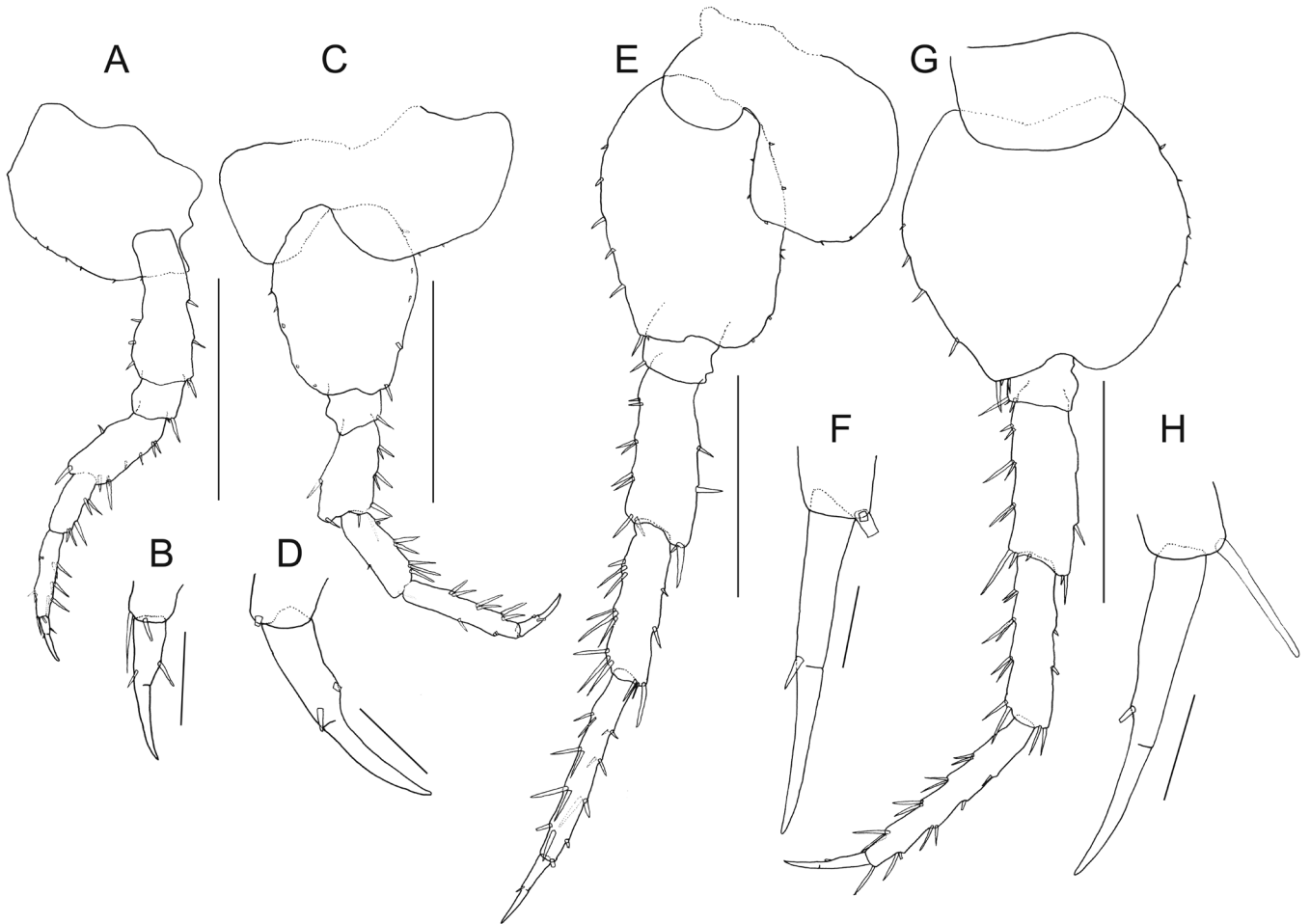


Fig. 4. *Solitroides motokawai*, new genus & species, holotype (VNMN 2017.01). A, pereopod 4, medial view; B, dactylus of pereopod 4, medial view; C, pereopod 5, medial view; D, dactylus of pereopod 5, medial view; E, pereopod 6, medial view; F, dactylus of pereopod 6, medial view; G, pereopod 7, lateral view; H, dactylus of pereopod 7, lateral view. Scale bars = 1.0 mm [A, C, E, G]; 0.1 mm [B, D, F, H].

of pereopod 3; dactylus not constricted on posterior margin, length  $0.6 \times$  length of propodus.

Pereopod 5 (Fig. 4C, D), length  $0.7 \times$  length of pereopod 3; coxa bilobed, ventral margin of posterior lobe with two setae; posterior margin of basis weakly expanded, anterior and posterior margins with setae; anterior margin of merus to propodus with robust and slender setae; dactylus length  $0.6 \times$  length of propodus.

Pereopod 6 (Fig. 4E, F), length  $0.9 \times$  length of pereopod 3; coxa bilobed, anterior lobe rounded without seta, anterodistal corner of posterior lobe quadrate with setae; posterior margin of basis weakly expanded, anterior and posterior margins with setae; anterior and posterior margins of merus to propodus with robust and slender setae; dactylus length  $0.4 \times$  length of propodus.

Pereopod 7 (Fig. 4G, H), length  $0.9 \times$  length of pereopod 3; coxa subquadrate, without seta; basis ovate, anterior and posterior margins with setae; anterior and posterior margins of merus to propodus with robust and slender setae; dactylus length  $0.3 \times$  length of propodus.

Coxal gills of gnathopod 2 and pereopod 6 largest, those of pereopods 3–5 same size (Fig. 5A–E); coxal gill of gnathopod

2 lobed at middle (Fig. 5A); coxal gills of pereopods 3–5 without lobe, distally attenuated (Fig. 5B–D); coxal gill of pereopod 6 complex, folded, its proximal and middle parts lobate (Fig. 5E).

Oostegites on gnathopod 2 to pereopod 5, small, narrowing distally, with 3–5 short and simple-tipped apical setae (Fig. 5F–I); oostegite of gnathopod 2 smallest (Fig. 5F).

Pleopods each with paired retinacula on peduncle; rami with short plumose setae (Fig. 5M–O). Pleopod 1 (Fig. 5M), peduncle marginally bare; inner ramus length  $1.6 \times$  length of peduncle; outer ramus length  $0.7 \times$  length of inner ramus. Pleopod 2 (Fig. 5N), length  $1.1 \times$  length of pleopod 1; peduncle marginally bare; inner ramus length  $1.1 \times$  length of peduncle; outer ramus length  $0.9 \times$  length of inner ramus. Pleopod 3 shortest (Fig. 5O), length  $0.7 \times$  length of pleopod 1; peduncle with numerous minute simple setae on its inner and outer margins; inner ramus length  $1.1 \times$  length of peduncle; outer ramus length  $1.0 \times$  length of inner ramus.

Uropod 1 (Fig. 6A), peduncle distolateral robust seta longer than subdistal one; inner ramus length  $0.8 \times$  length of peduncle, inner margin with three robust setae, outer margin without setae; outer ramus almost as long as inner ramus, inner and outer margins without setae.

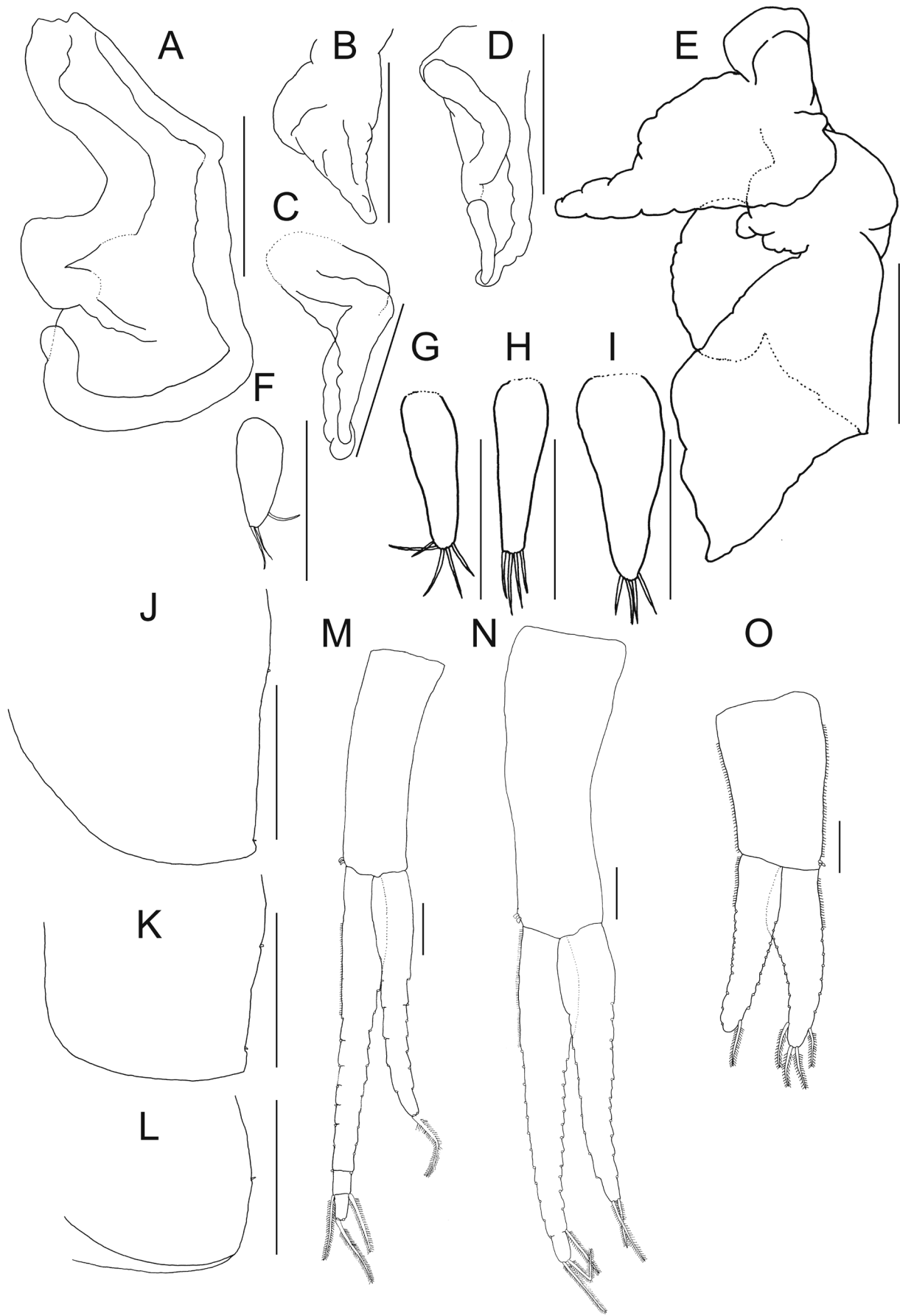


Fig. 5. *Solitroides motokawai*, new genus & species, holotype (VNMN 2017.01). A, coxal gill of gnathopod 2, lateral view; B, coxal gill of pereopod 3, lateral view; C, coxal gill of pereopod 4, lateral view; D, coxal gill of pereopod 5, lateral view; E, coxal gill of pereopod 6, lateral view; F, oostegite of gnathopod 2, lateral view; G, oostegite of pereopod 3, lateral view; H, oostegite of pereopod 4, lateral view; I, oostegite of pereopod 5, lateral view; J, epimeral plate 1, lateral view; K, epimeral plate 2, lateral view; L, epimeral plate 3, lateral view; M, pleopod 1, posterior view; N, pleopod 2, posterior view; O, pleopod 3, posterior view. Scale bars = 0.5 mm [A–L]; 0.1 mm [M–O].

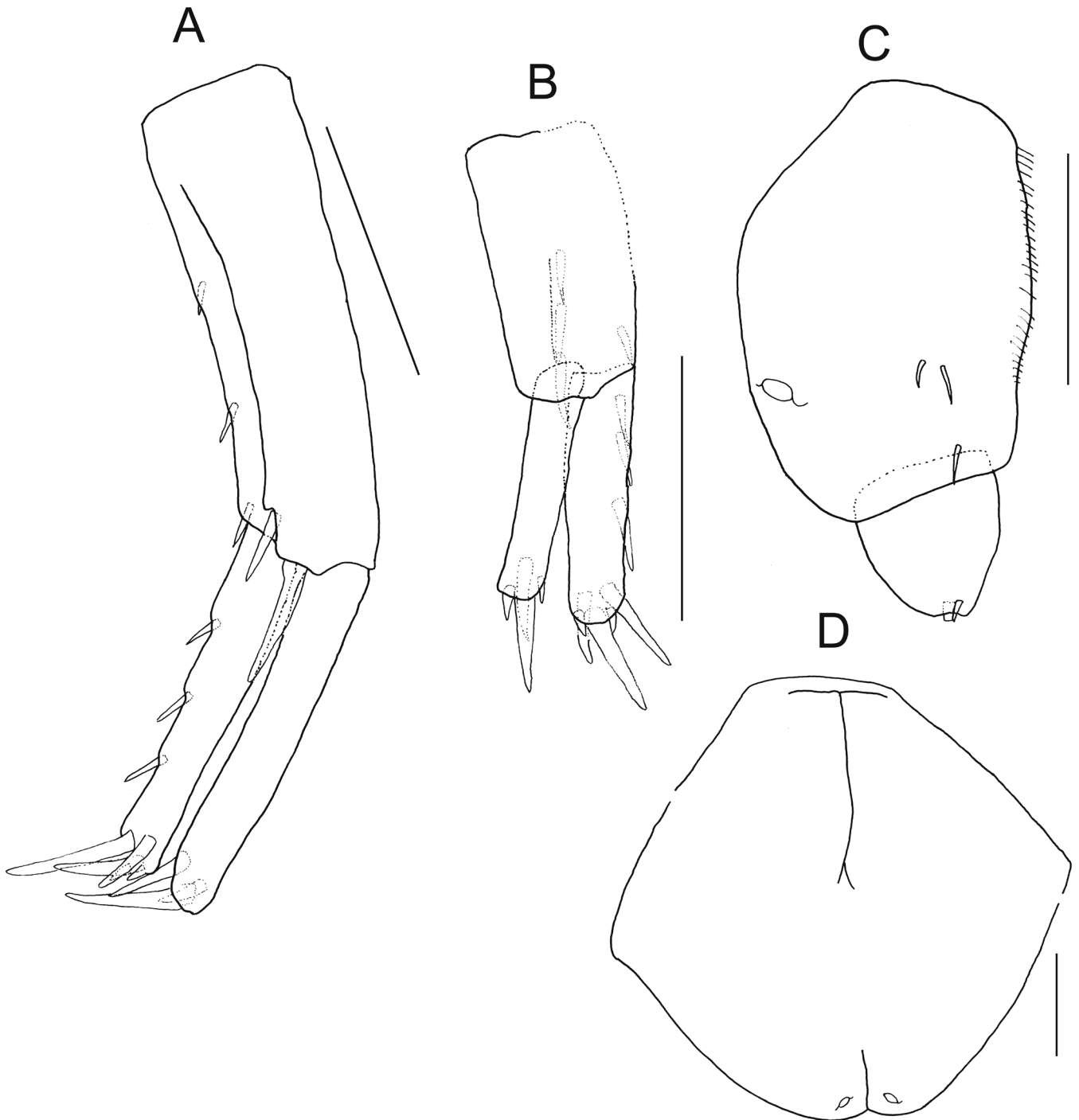


Fig. 6. *Solitroides motokawai*, new genus & species, holotype (VNMN 2017.01). A, uropod 1, lateral view; B, uropod 2, ventral view; C, uropod 3, dorsal view; D, telson, dorsal view. Scale bars = 0.5 mm [A, B]; 0.1 mm [C, D].

Uropod 2 (Fig. 6B), peduncle with one and three robust setae on inner and outer margins, respectively; inner ramus length  $0.9 \times$  length of peduncle, inner margin with three robust setae; outer ramus length  $0.9 \times$  length of inner ramus, inner and outer margins without setae.

Uropod 3 (Fig. 6C), length  $1.6 \times$  width, with one robust seta laterally, a few setae dorsally; ramus one-articulate, short, length  $0.4 \times$  length of peduncle, with two apical setae.

Telson rhombic, equal in length to width, apical part slightly cleft; with one apical seta per lobe (Fig. 6D).

**SEM observation of maxilliped.** Scanning electron micrographs of the maxilliped removed from KUZ Z1865 showed that the article 3 of the maxilliped palp was coalescing with the article 4 of the palp (Fig. 7). The boundary between them is recognised as a trace of segmentation (Fig. 7B). This characteristic could hardly be observed under a light microscope.

**Distribution and natural history.** Known only from the type locality. This landhoppers were found along mountain streams, and under fallen leaves with high moisture in the mountainous habitat. Only non-ovigerous females and a



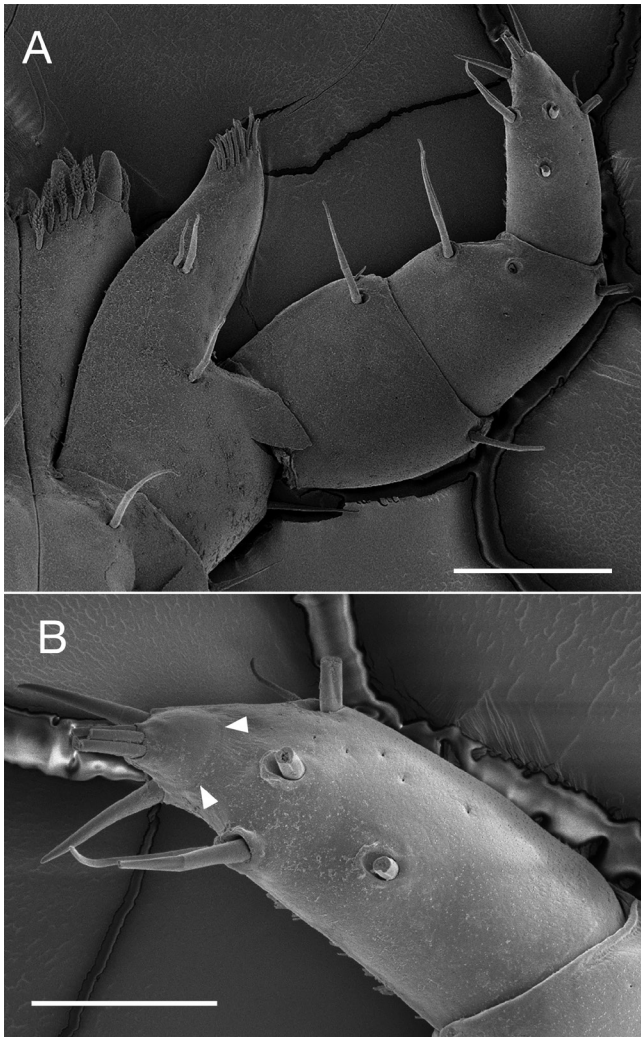


Fig. 7. Scanning electron micrographs of *Solitroides motokawai*, new genus & species, paratype (KUZ Z1865). A, maxilliped, ventral view; B, distal part of maxillipedal palp, arrowhead indicates boundary between articles 3 and 4, ventral view. Scale bars = 100  $\mu$ m [A]; 50  $\mu$ m [B].

juvenile of this species were collected during the survey. Several females might be mature individuals, since they possessed the oostegites bearing apical setae.

**DNA sequences.** In total eight nucleotide sequences were determined: holotype (VNMN 2017.01), four sequences, 28S (LC223811; 1250 bp), H3 (LC223813; 328 bp), COI (LC223812; 658 bp), and 16S (LC223810; 421 bp); and paratype (KUZ Z1867), four sequences, 28S (LC223807; 1250 bp), H3 (LC223809; 328 bp), COI (LC223808; 658 bp), and 16S (LC223806; 421 bp).

**Etymology.** The specific name is a noun in the genitive case formed directly from the name of Mr. Masaharu Motokawa, who provided the opportunity for TN to conduct the field survey in Vietnam.

## DISCUSSION

To our knowledge, simplidactylate landhopper species have been classified into seven genera (Bousfield, 1984; Friend,

1987): *Arcitalitrus* Hurley, 1975; *Austrotroides* Friend, 1982; *Keratroides* Hurley, 1975; *Mysticotalitrus* Hurley, 1975; *Neorchestia* Friend, 1987; *Protaustrotroides* Bousfield, 1984; and *Talitriator* Methuen, 1913. Among these seven genera, the new genus *Solitroides* closely resembles *Mysticotalitrus* in the following combination of the characters: maxilla 1 with inward leaning outermost robust seta on outer plate; four-dentate lacinia mobilis of left mandible; oblique palmar margin of propodus on female gnathopod 1; coxal gills 2 and 6 largest, coxal gill 6 complex, folded, lobate; oostegite 5 with apical setae; and rami of pleopods 1–3 developed, multi-articulate. However, *Solitroides* can be differentiated from the latter genus by the following characteristics (character states of *Mysticotalitrus* in parentheses): article 4 of palp of maxilliped coalescing with article 3 (distinct); peduncle of pleopod 3 with simple setae on both inner and outer margins (plumose setae on outer margin); and apical part of telson slightly cleft (telson entire).

The present genus also shows similarity to *Arcitalitrus*, *Neorchestia*, and *Talitriator* in the developed rami of pleopods 1–3. But, *Solitroides* is clearly distinguishable from *Arcitalitrus* by the maxillipedal palp three-articulate (article 4 distinct in *Arcitalitrus*), the folded and lobate coxal gill 6 (anseriform), the rounded posterodistal corner of the epimeral plate 3 (subsquare), and the apical part of telson slightly cleft (telson entire); from *Neorchestia* by the maxillipedal palp three-articulate (article 4 distinct), and the oostegite 5 with apical setae (without setae); and, from *Talitriator* by the merus of female gnathopod 2 without lobe (lobate, except for *T. cylindripes* [Barnard, 1940] sensu Griffiths [1999]), and the bare peduncle of pleopod 2 (with plumose setae on outer margin, except for *T. calva* [Barnard, 1940] sensu Griffiths [1999]). *Austrotroides*, *Keratroides*, and *Protaustrotroides* are characterised by the pleopod rami lacking or vestigial; from those genera, *Solitroides* can be distinguished by the developed rami of pleopods 1–3.

In addition to the seven simplidactylate landhopper genera, four palustral talitrid genera, *Chiltonorchestia* Bousfield, 1984; *Cochinorchestia* Lowry & Peart, 2010; *Micrororchestia* Bousfield, 1984; and *Uhlorchestia* Bousfield, 1984; and one beach-flea genus *Protorchestia* Bousfield, 1982 are assigned to simplidactylate talitrid taxa. *Solitroides* can be distinguished from these five genera by the following characteristics (Bousfield, 1982, 1984; Bousfield & Heard, 1986; Richardson, 1996; Lowry & Peart, 2010; Lowry & Springthorpe, 2015b): left lacinia mobilis of mandible four-dentate (five-dentate in *Protorchestia*); article 4 of maxillipedal palp coalescing with article 3 (article 4 distinct in the five genera); basis to propodus of gnathopod 1 without lobe (merus to propodus each with posterior lobe in *Chiltonorchestia*, *Cochinorchestia*, *Micrororchestia* and *Protorchestia*); and outer ramus of uropod 1 with bare margin (with setose margin in *Cochinorchestia* and *Uhlorchestia*).

Although it remains unconfirmed whether the palustral talitrid *Eorchestia* Bousfield, 1984 is a simplidactylate genus (Lowry & Baldanzi, 2016), *S. motokawai* could be clearly differentiated from *Eorchestia* species by the

basis to propodus of gnathopod 1 without lobe (merus to propodus each with posterior lobe in *Eorchestia*), the ramus of uropod 3 shorter than the peduncle (subequal in length or slightly longer than peduncle), and the telson with one apical seta per lobe (two apical setae per lobe). The other palustral talitrid genus *Chelorchestia* Bousfield, 1984 was characterised by the simplidactylate pereopods 3 and 4, and the dactyli of pereopods 5–7 with the trace of outer marginal cusps (Bousfield, 1984). According to taxonomic studies (Bousfield, 1984; Smith & Heard, 2001; Valencia & Giraldo, 2009), *Solitroides* can be clearly distinguished from *Chelorchestia* by the lobate or distally attenuated coxal gills (sac-like, weakly lobate in *Chelorchestia*), and the telson without lateral setae (with lateral robust setae).

Duncan (1994) established five genera for talitrid amphipods inhabiting New Zealand: *Dana* Lowry, 2011 (replacement name for *Tara* Duncan, 1994); *Kanikania* Duncan, 1994; *Makawe* Duncan, 1994; *Puhuruhuru* Duncan, 1994; *Waematau* Duncan, 1994. Among them, *Puhuruhuru* is defined as the cuspidactylate landhopper genus (Fenwick & Webber, 2008). Additionally, *Solitroides* differs from *Kanikania*, *Makawe*, and *Waematau* in the following characteristics: outer plate of maxilliped arcuate (ovate in *Waematau*); palp article 2 of maxilliped without lobe (lobate in *Waematau*); merus of female gnathopod 1 without lobe (lobate in *Kanikania*); merus of female gnathopod 2 without lobe (lobate in *Makawe*); and rami of pleopod 3 developed (vestigial, or lacking in *Waematau*). The Duncan's figure of *Dana hauturu* (Duncan, 1994) clearly shows this species is cuspidactylate: *Solitroides* is differentiated from *Dana* by the marginally bare outer ramus of uropod 1 (setose in *Dana*).

Due to the lack of male specimens of *S. motokawai*, it remains unknown whether the genus *Solitroides* is a member of the sexually dimorphic group, i.e., whether it belongs to the *Talitrus*-group, or to the *Orchestia*-group, defined by Lowry & Coleman (2012). The DNA sequences of the holotype and paratype of *S. motokawai* determined in this study will help identify male individuals of this species. With the aid of these DNA sequences, therefore, male characteristics of *S. motokawai* should be documented by future faunal and taxonomic studies of the Indochinese Talitridae.

Simplidactylate landhoppers had so far been recorded from South Africa, Saint Helena, Ascension Island, Australia, and Tasmania (Bousfield, 1984; Stock & Biernbaum, 1994; Griffiths, 1999; Miyamoto & Morino, 2012): their distribution had been restricted to the Southern Hemisphere, and simplidactylate landhoppers had been considered as a Gondwana-origin group (Bousfield, 1984). However, the locality of *S. motokawai* is located in the Northern Hemisphere, and separated by a long distance from the previously known distribution of simplidactylate landhoppers. Therefore, the present finding provides new insight into the Bousfield's biogeographical history of the simplidactylate landhoppers. Further faunal and systematic studies are essential to elucidate the true biogeographical and evolutionary history of these "plesiomorphic" terrestrial talitrids.

## KEY TO TALITRID SPECIES IN VIETNAM

The previous studies recorded six talitrid species from Vietnam (Hou & Li, 2003; Dang & Le, 2011; Morino, 2013). Accordingly, a key to the seven species including *Solitroides motokawai* is provided herein.

1. Ventral submarginal part of epimeral plates with slits.....2  
– Ventral submarginal part of epimeral plates without slits.....3
2. Palmar corner of propodus of male gnathopod 2 strongly produced. Posterior margin of dactylus of male gnathopod 2 with cusp.....*Floresorchestia vugiaensis* Dang & Le, 2011  
– Palmar corner of propodus of male gnathopod 2 not produced. Posterior margin of dactylus of male gnathopod 2 without cusp.....*Floresorchestia hanoiensis* Hou & Li, 2003
3. Eyes rounded. Outer plate of maxilliped not reaching end of palp article 2 of maxilliped.....4  
– Eyes quadrate. Outer plate of maxilliped reaching end of palp article 2 of maxilliped.....*Vietorchestia quadrata* Dang & Le, 2011
4. Pereopods 3–7 cuspidactylate .....5  
– Pereopods 3–7 simplidactylate.....*Solitroides motokawai* new genus & species
5. Distolateral robust seta of peduncle of uropod 1 straight.....6  
– Distolateral robust seta of peduncle of uropod 1 sinuate .....*Talitroides topitotum* (Burt, 1934)
6. Anterodistal corner of posterior lobe of coxa 6 quadrate, or produced .....7  
– Anterodistal corner of posterior lobe of coxa 6 smoothly rounded.....*Talorchestia martensii* (Weber, 1892)
7. Articles 4 and 5 of antenna 2 thick. Distal tip of dactylus of male gnathopod 2 drastically narrowed.....*Platorchestia japonica* (Tattersall, 1922)  
– Articles 4 and 5 of antenna 2 slender. Distal tip of dactylus of male gnathopod 2 gradually narrowed.....*Platorchestia vietnamica* Dang & Le, 2011

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