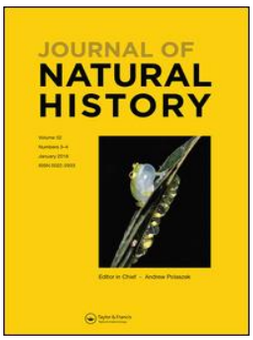

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# A new landhopper species of *Myanmarorchestia* (Crustacea: Amphipoda: Talitridae) from Yunnan, China

Takafumi Nakano [a], Ko Tomikawa [a], Zhonge Hou [b] and Hiroshi Morino [c]

[a]Department of Science Education, Graduate School of Education, Hiroshima University, Higashihiroshima, Hiroshima, Japan; [b]Institute of Zoology, Chinese Academy of Sciences, Beijing, PR China; [c]Department of Zoology, National Museum of Nature and Science, Tsukuba, Japan

**ABSTRACT**

A new landhopper talitrid, *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., from Yunnan Province, China is described. Since species of *Myanmarorchestia* were known only from Mt. Victoria of the Arakan Mountains of Myanmar, this is the first record of the genus from China. *Myanmarorchestia nunomurai* is characterised by its coxal gills on gnathopod 2 to pereopod 6 without filamentous projections while the other congeners from Myanmar possess some/all of the coxal gills with filamentous projections. Additionally, *M. nunomurai* can be diagnosed by the sexually dimorphic uropod 2, of which the outer ramus bears a robust seta on the midlateral surface and a few rows of small teeth on the middle to distodorsal surface.

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**KEYWORDS**
Talitroidea; simplidactylate; new species; first record; SEM

## Introduction

The family Talitridae, which are classified into more than 60 genera (Lowry and Myers 2013; Lowry et al. 2016), contains species that have adapted to semi- and fully terrestrial habitats. Talitrid amphipods are split into two subgroups on the basis of the characteristics of male gnathopod 2 (Lowry and Coleman 2012): the *Talitrus*-group, characterized by the undeveloped, mitten-shaped gnathopod 2; and the *Orchestia*-group, characterized by the developed massive gnathopod 2. Additionally, talitrids can be divided into two informal groups according to the characteristics of the dactyli of pereopods 3–7 (Bousfield 1982; Miyamoto and Morino 2012): simplidactylus, lacking cusps on the pereopodous dactyli; and cuspidactylus, bearing uni- or bi-cusps on the pereopodous dactyli.

Until recently, simplidactylate 'landhoppers' *sensu* Bousfield (1984) had been reported from locations in the Southern Hemisphere, i.e. South Africa, Saint Helena, Ascension Island, Australia and Tasmania (Bousfield 1984; Stock and Biernbaum 1994; Griffiths 1999). However, recent taxonomic studies of Talitridae revealed that they are indigenous to montane habitats in Indochina as well; two genera were established for South-East Asian simplidactylate landhoppers: *Solitroides* Suzuki et al., 2017 and *Myanmarorchestia* Hou in Hou and Zhao, 2017. *Solitroides* is a monospecific genus, and has been known only from the Annamite Range

**CONTACT** Takafumi Nakano nakano@zoo.zool.kyoto-u.ac.jp Department of Zoology, Graduate School of Science, Kyoto University, Kyoto 606-8502, Japan



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in Vietnam, which is located in eastern Indochina (Figure 1) (Suzuki et al. 2017). *Myanmarorchestia* contains three species, and all species were recorded from around Mt. Victoria of the Arakan Mountains of Myanmar in western Indochina (Figure 1) (Hou and Zhao 2017; Zheng and Hou 2017).

All the South-East Asian simplidactylate-landhoppers can be defined as montane species: *S. motokawai* Suzuki et al., 2017 was collected from localities at elevations between 1700 and 2000 m (Suzuki et al. 2017); *M. peterjaegeri* Hou in Hou and Zhao, 2017 was collected from an altitude of 2150 m, *M. seabri* Hou in Hou and Zhao, 2017 from ca. 1580 m, and *M. victoria* Hou in Zheng and Hou, 2017 from ca. 2650 m (Hou and Zhao 2017; Zheng and Hou 2017). However, while the taxonomic status of talitrid amphipods in South-East Asia has been investigated and reviewed for the cuspidactylate supralittoral to coastal forest genera, e.g. *Floresorchestia* Bousfield, 1984 by Lowry and Springthorpe (2015) and *Talorchestia* Dana, 1852 by Lowry et al. (2017), the species diversity of inland to montane talitrids from this region remains unclarified.

During the 'Sino-Japanese Co-operative Studies on the Soil Fauna of Subtropical Area of China' conducted by the Chinese representative, Professor Yin Wen-ying and the Japanese representative, Professor Jun-ichi Aoki (Aoki et al. 2000), simplidactylate landhoppers were collected from mountainous habitats in Tengchong, Yunnan, which are close to the border between China and Myanmar. They are described herein as a new species of the genus *Myanmarorchestia* by the first (T.N.) and the last (H.M.) authors.

## Material and methods

### *Sample collection*

Talitrid amphipods were collected from two stations in Huanxipo in Tengchong, Yunnan Province, China in 1996 (Figure 1). The detailed collecting method was referenced in Aoki et al. (2000). The specimens were preserved in 70–80% ethanol with glycerol added.

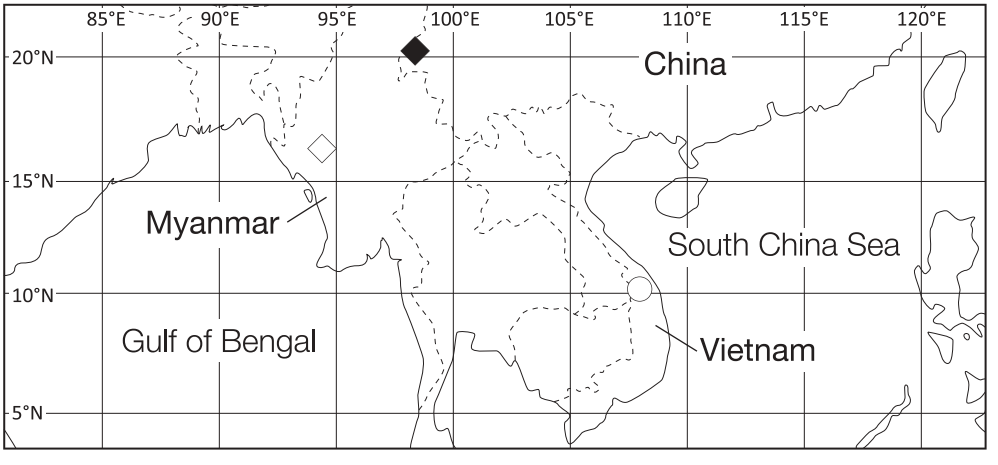


**Figure 1.** Map showing the collection locality of the specimens and the recorded localities of *Solitroides* Suzuki et al., 2017; *Myanmarorchestia* Hou in Hou and Zhao, 2017. Black diamond denotes *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov.; white diamond, the other *Myanmarorchestia* species (Hou and Zhao 2017; Zheng and Hou 2017); white circle, *Solitroides motokawai* Suzuki et al., 2017 (Suzuki et al. 2017).

### Morphological examination

Appendages of the examined specimens were dissected in 70% ethanol and mounted in gum-chloral medium on glass slides under a stereoscopic microscope (Leica M125; Leica Microsystems, Wetzlar, Germany). The specimens were examined using the stereoscopic microscope and a light microscope (Nikon Eclipse Ni; Nikon, Tokyo, Japan), and illustrated with the aid of a drawing tube. 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 examined in this study are deposited at the Institute of Zoology, Chinese Academy of Sciences (IZCAS), Beijing, and in the Department of Zoology, National Museum of Nature and Science, Tsukuba (NSMT).

### Scanning electron microscopy (SEM)

Gnathopods 1 and 2 of each of the male (NSMT-Cr 25804) and the female (IZCAS-I-A2591-3) specimens of the Yunnan species were removed and dehydrated through a graded ethanol series, and dried using hexamethyldisilazane (Nation 1983). Then, the gnathopods were sputter-coated with gold, and observed using a scanning electron microscope (JCM-6000 NeoScope; JEOL, Tokyo, Japan).

## Taxonomy

Family **TALITRIDAE** Rafinesque, 1815
Genus ***Myanmarorchestia*** Hou in Hou and Zhao, 2017
***Myanmarorchestia nunomurai*** Nakano and Morino, sp. nov.
(Figures 2–12)

### Type material

***Holotype.*** Male (14.9 mm), IZCAS-I-A2591-1 (Figures 2(a), 3), collected from Huanxipo, Tengchong, Yunnan Province, China (~25.17°N, ~98.34°E), Station #96HXP-1 (elevation 1950 m; vegetation, *Pinus armandii*, *Lithocarpus variolosus*, *Quercus glauca*, *Rhus chinensis*, and *Chimonobambusa yunnanensis*), by Noboru Nunomura, on 14 October 1996.

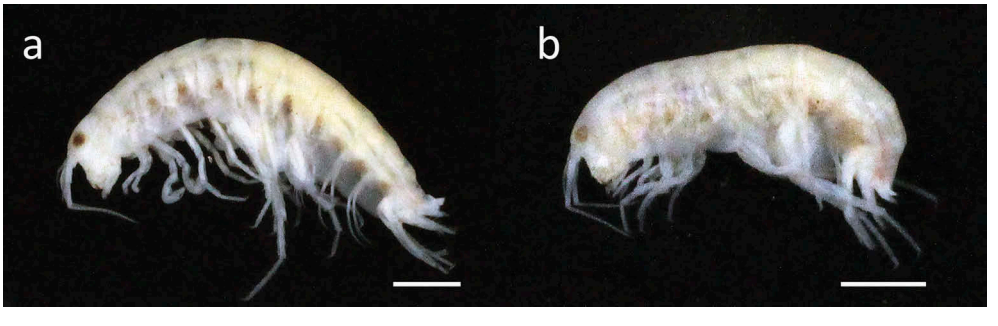


**Figure 2.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., lateral views of preserved specimens. (a) Holotype, male, IZCAS-I-A2591-1. (b) Paratype, female, NSMT-Cr 25805. Scale bars, 2 mm.

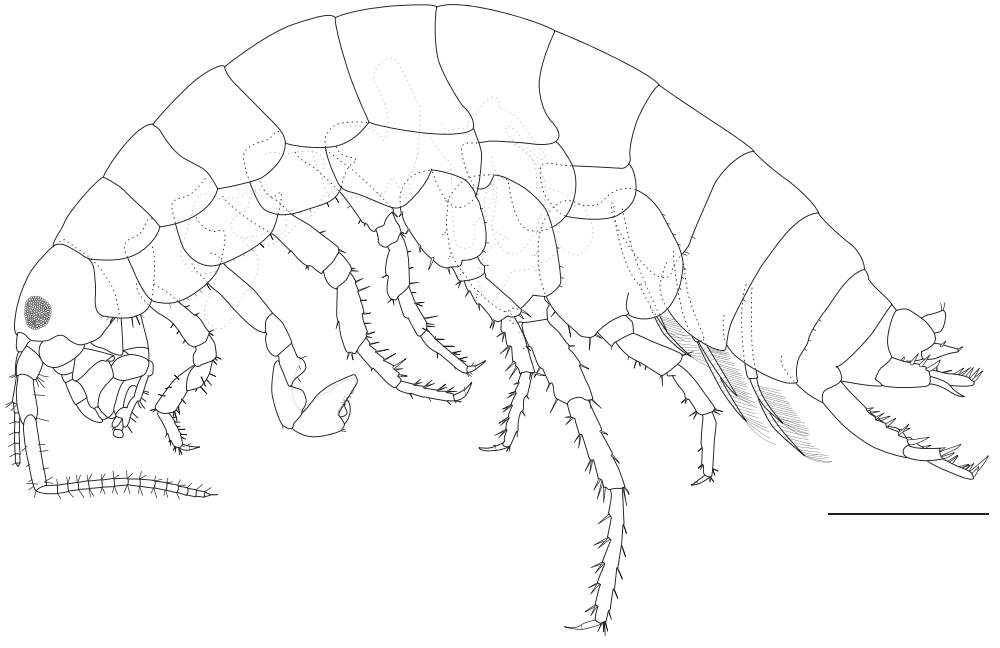

**Figure 3.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1, habitus, lateral view. Scale bar, 2 mm.

***Paratypes.*** In total 1 male 3 females: female (9.7 mm), IZCAS-I-A2591-2, data same as for holotype; male (13.7 mm), NSMT-Cr 25804, female (11.8 mm), NSMT-Cr 25805 (Figure 2(b)), female (12.3 mm), IZCAS-I-A2591-3, collected from Station #96HXP-2 (elevation 1960 m; vegetation, *Pinus armandii*, *Lithocarpus variolosus*, *Quercus glauca*, and *Rhus chinensis*), the other collection data same as for holotype.

## *Diagnosis*

Palp of maxilla 1 1-articulate; palpal article 2 of maxilliped broad; coxa on gnathopod 1 produced proximally; dactylus of male gnathopod 2 arcuate; coxa of pereopod 4 with distinct posterior cusp; coxal gills on gnathopod 2 to pereopod 6 large, convoluted, without filamentous projections; uropod 2 sexually dimorphic, male outer ramus bearing 1 small robust seta on midlateral surface and a few rows of small teeth on middle to distodorsal surface; peduncle of uropod 3 bearing 1 long robust seta; telson with bare dorsal surface.

## *Description*

### *Male [holotype, IZCAS-I-A2591-1; pereopod 7 based on paratype, NSMT-Cr 25804].*

Head (Figure 3) with short rostrum; antennal sinus shallow, rounded; eyes oval, major axis ca. 0.3 times as long as head. Dorsal surfaces of pereonites, pleonites, and urosomites smooth (Figure 3). Epimeral plates 1–3 with 2, 1, 4 setae on posterior margins, respectively (Figure 4(a–c)); posterodistal corner of epimeral plates 1 rounded, those of epimeral plates 2–3 weakly pointed.

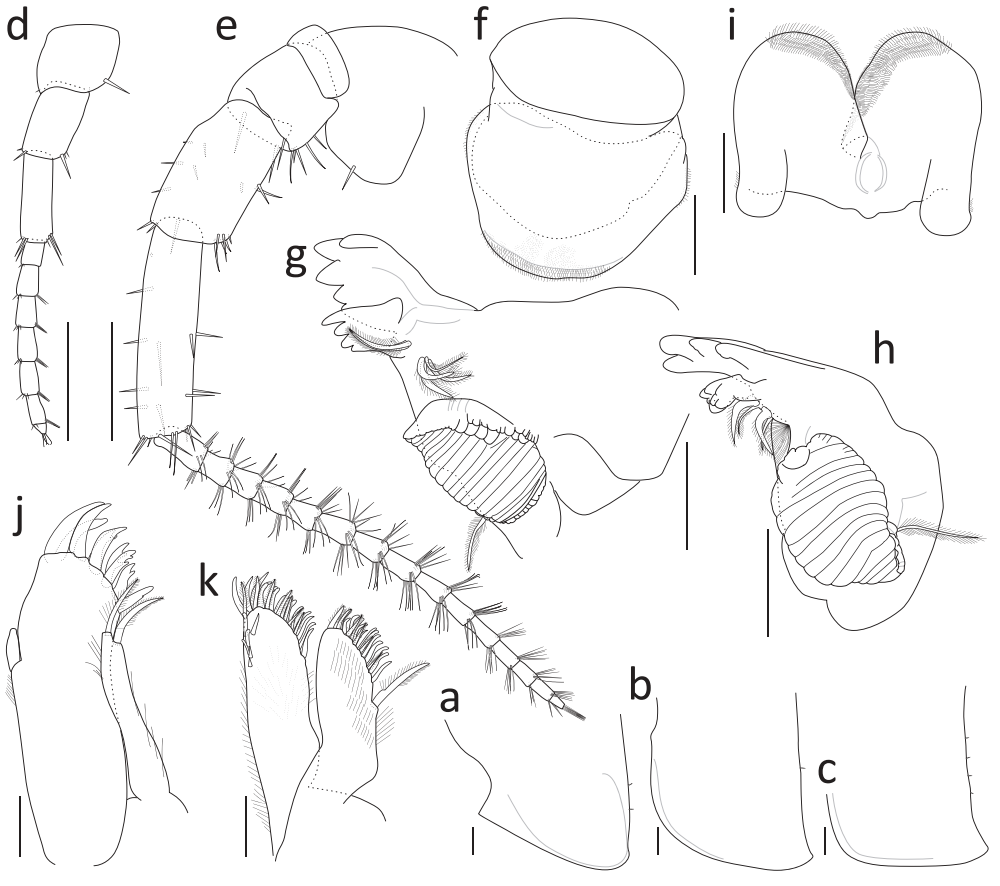


**Figure 4.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1. (a–c) Left epimeral plates 1–3, respectively, lateral views. (d) Left antenna 1, lateral view. (e) Left antenna 2, lateral view. (f) Upper lip, anterior view. (g) Left mandible, medial view. (h) Right mandible, medial view. (i) Lower lip, ventral view. (j) Left maxilla 1, dorsal view. (k) Left maxilla 2, dorsal view. Scale bars, 0.2 mm (a–c, f–i); 0.5 mm (d, e); 0.1 mm (j, k).

Antenna 1 (Figure 4(d)): 0.4 times as long as antenna 2, exceeding middle part of peduncular article 5 of antenna 2; peduncular articles 1–3 in length ratio of 1.0: 1.1: 1.2; flagellum 7-articulate, subequal to peduncle in length.

Antenna 2 (Figure 4(e)): 0.3 times as long as body length; peduncular articles robust, article 5 longest, subequal in length to articles 3 and 4 combined; flagellum 15-articulate, length 0.8 times as long as peduncle, last article cone-shaped, forming virgula divina.

Buccal mass deep, ca. 1.2 times as high as head (Figure 3).

Upper lip with lateral margins bearing minute setae (Figure 4(f)); distal margin rounded with minute-setal patch.

Mandible with left and right incisors 5- and 4-dentate, respectively (Figure 4(g), 4(h)); left lacinia mobilis 4-dentate (Figure 4(g)); right lacinia mobilis bifid, bearing several teeth (Figure 4(h)); each molar process triturative, with plumose seta (Figure 4(g), 4(h)).

Lower lip with broad outer lobes; inner lobes indistinct (Figure 4(i)).

Maxilla 1 with inner and outer plates and palp (Figure 4(j)); inner plate slender, apical margin of inner plate with 2 plumose setae; outer plate with 6 serrate and 3 simple robust setae, innermost apical robust seta leaning inwards; palp small, 1-articulate.

Maxilla 2 (Figure 4(k)): inner plate with 1 long plumose seta on medial margin, apical margin with plumose and simple setae; outer plate slightly longer than inner plate, apical margin with plumose and simple setae.

Maxilliped (Figure 5(a)): inner plate with 3 robust setae and several plumose setae on apical margin; outer plate ovate, apically rounded, with 2 plumose setae on lateroapical margin, with many simple setae on subapical margin; palp 4-articulate; palpal article 2 broad, outer margin with 3 setae, medially weakly expanded with 3 setae on inner submarginal part; palpal article 3 ovate, outer distal corner with 6 setae, apical submarginal part with 2 robust setae, inner submarginal part with more than 5 setae; palpal article 4 distinct, with 2 robust and 3 slender setae apically.

Gnathopod 1 (Figure 5(b)): coxa produced proximally, ventral margin with 9 simple setae; anterior and posterior margins of basis with simple and robust setae, respectively; ischium quadrate, posterodistal corner with a few setae; merus with simple setae on posterior margin; carpus lacking pellucid lobe, 3.0 times as long as wide, anterior margin with few slender setae, posterior margin with simple setae, each of anterodistal and posterodistal corners with simple setae; propodus slender and simple, 0.7 times as long as carpus, 3.1 times as long as wide, anterior margin with 1 simple seta and 2 pairs of simple setae, anterodistal corner with 5 simple setae, posterior margin with 3 robust setae and 1 pair of robust setae, lateral surface with 3 submarginal robust setae; dactylus simple, 0.5 times as long as propodus, posterior margin with simple seta, hinge of unguis with 2 simple setae (Figure 5(c)).

Gnathopod 2 (Figure 5(d)): ventral margin of coxa with 12 simple setae, tip of posterior cusp blunt; anterior submarginal part of basis with 3 setae; ischium 0.9 times as long as merus; merus, posterodistal lobe present, its surface covered with scabrous surface; carpus 2.0 times as long as wide, developed posterodistal lobe with scabrous surface, anterodistal corner with 3 setae; propodus transitional form, weakly chelate, 1.3 times as long as carpus, 2.0 times as long as wide, anterodistal corner with 4 setae, lateral and medial surfaces with 12 and 16 slender setae, respectively, palmar margin with many simple setae, posterior lobe produced anteriorly, narrowing distally with scabrous surface (Figure 5(e)); dactylus, arcuate, much shorter than palmar margin, each of distal tip and posterodistal margin with 1 short seta, posterior margin of base with 3 short setae (Figure 5(e)).

Pereopods 3–7 simplidactylate (Figures 6, 7); propodi of pereopods 3 and 4 lacking locking robust setae (Figure 6(b), 6(d)).

Pereopod 3 (Figure 6(a)): coxa wider than deep, ventral margin of coxa with 9 simple setae; basis with robust setae and simple seta and robust setae on anterior and posterior margins, respectively; merus to dactylus in length ratio of 1.0: 0.8: 1.0: 0.4; posterior margin of merus with 2 and 2 pairs of simple setae and with 1 robust seta, anterodistal corner with 1 simple and 1 robust seta, posterodistal corner with 2 simple setae and 1 pair of robust setae; anterior margin of carpus with 1 pair of robust setae, anterodistal corner with 1 simple seta, posterior margin with 1 and 3 pairs of robust setae, posterodistal corner with 2 robust setae; propodus slender, anterior margin with 3 pairs of

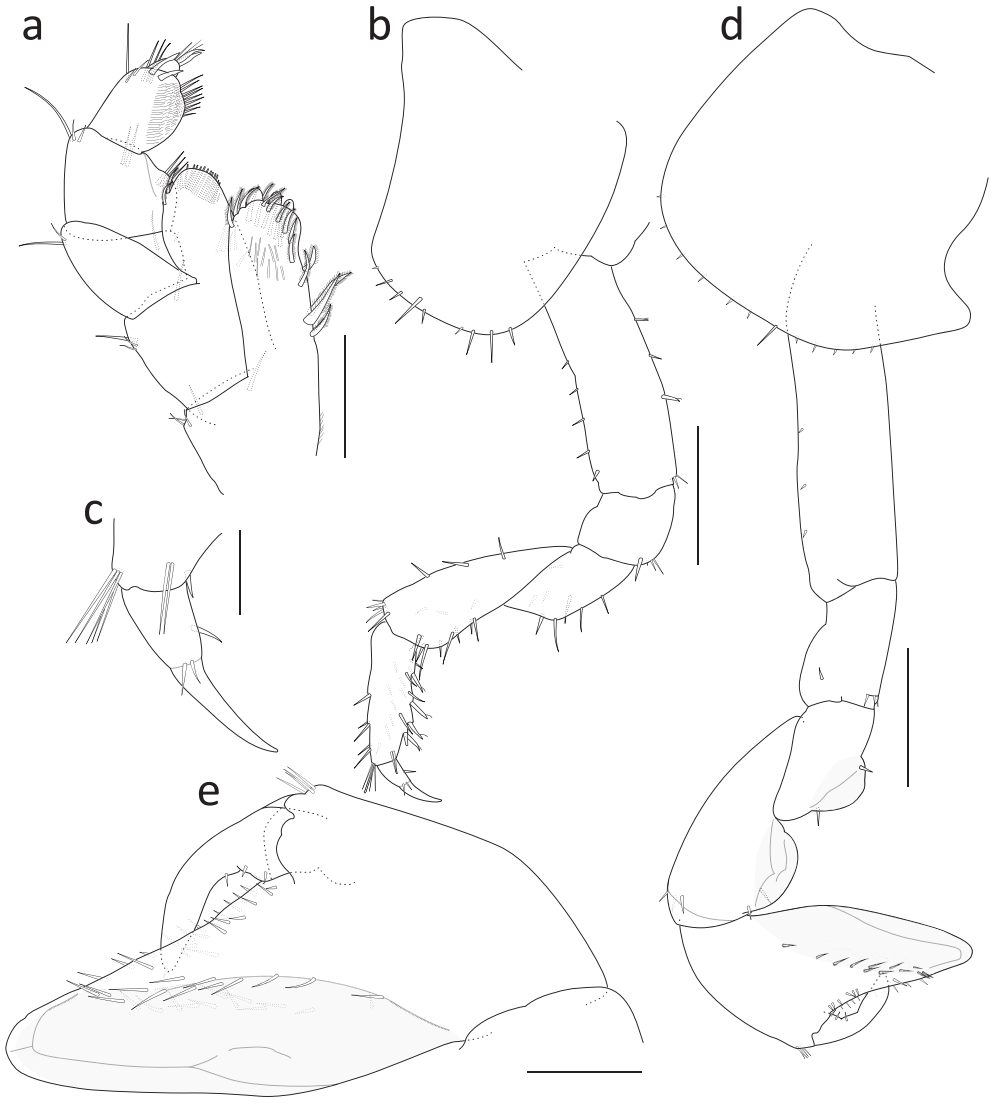


**Figure 5.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1. (a) Left maxilliped, dorsal view. (b) Left gnathopod 1, lateral view. (c) Dactylus of left gnathopod 1, lateral view. (d) Left gnathopod 2, lateral view. (e) Propodus and dactylus of left gnathopod 2, lateral view. Scale bars, 0.2 mm (a, e); 0.5 mm (b, d); 0.1 mm (c).

robust setae, anterodistal corner with 1 robust and 2 simple setae, posterior margin with 4 pairs of robust setae; dactylus with 2 simple setae on base (Figure 6(b)).

Pereopod 4 (Figure 6(c)): 0.9 times as long as pereopod 3; coxa wider than deep, ventral margin with 11 simple setae, tip of posterior cusp sharp; basis with a few and 3 robust setae on anterior and posterior margins, respectively; merus to dactylus in length ratio of 1.0: 0.9: 1.0: 0.4; anterior margin of merus with 1 robust seta, anterodistal corner with 1 simple and 1 robust setae, posterior margin with 3 simple and 1 robust setae, posterodistal corner with 2 simple and 1 robust setae; anterior margin of carpus with 1

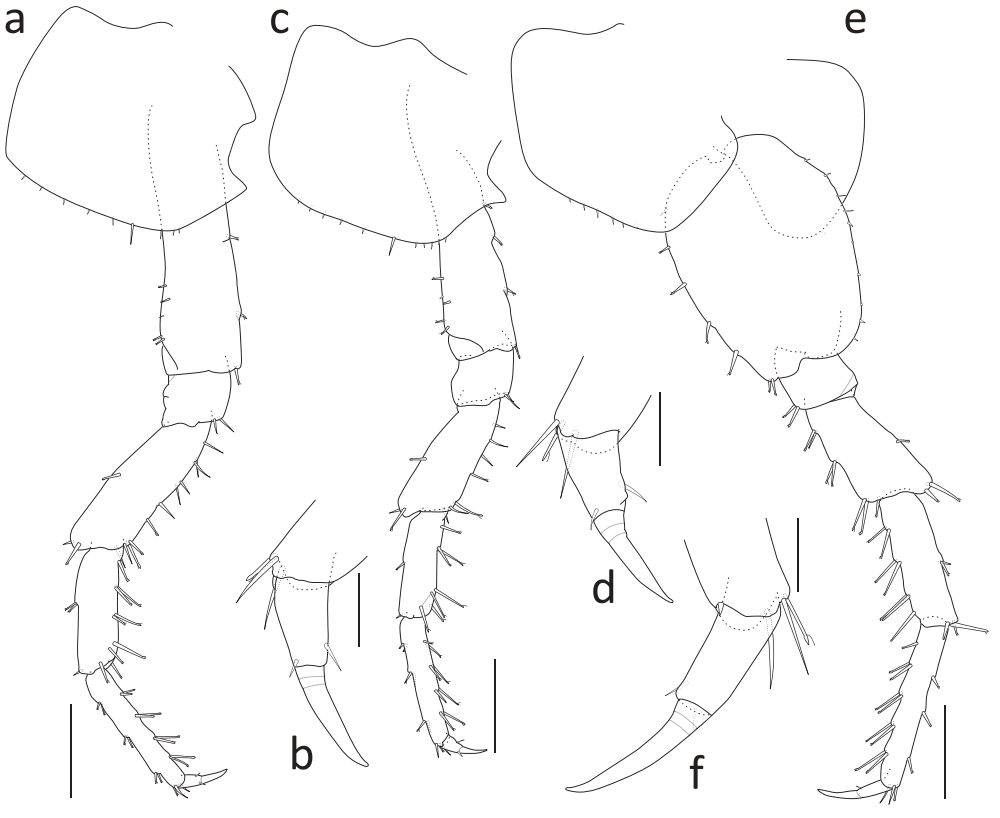


**Figure 6.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1. (a) Left pereopod 3, lateral view. (b) Dactylus of left pereopod 3, lateral view. (c) Left pereopod 4, lateral view. (d) Dactylus of left pereopod 4, lateral view. (e) Left pereopod 5, lateral view. (f) Dactylus of left pereopod 5, lateral view. Scale bars, 0.5 mm (a, c, e); 0.1 mm (b, d, f).

robust seta, anterodistal corner with 1 simple seta, posterior margin with 1 and 2 pairs of robust setae, posterodistal corner with 1 pair of robust setae; anterior margin of propodus with 3 pairs of robust setae, anterodistal corner with 2 simple and 1 robust setae, posterior margin with 4 pairs of robust setae; dactylus not pinched, with 2 simple setae on base (Figure 6(d)).

Pereopod 5 (Figure 6(e)): almost as long as pereopod 3; coxa bilobed, ventral margin of anterior lobe straight, with 6 simple setae, posterior lobe with 1 seta; basis subovate, anterior margin with 5 robust setae, anterodistal corner with 2 robust setae, posterior margin weakly expanded, with 10 simple setae; merus to dactylus in length ratio of 1.0: 1.2: 1.4: 0.6; anterior margin of merus with 2 pairs of robust setae, anterodistal corner with 3 robust setae, posterior margin with 1 robust seta, posterodistal corner produced, rounded, with 3 robust setae; anterior margin of carpus with 3 pairs of robust setae, anterodistal corner with 1 robust seta, posterior margin with 1 pair of robust setae, posterodistal corner with 3 robust setae; propodus slender, anterior margin with 1 and 4 pairs of robust setae, anterodistal corner with locking robust seta (Figure 6(f)), posterior margin with 3 robust setae, posterodistal corner with 2 simple and 1 robust setae; dactylus with 2 simple setae on base (Figure 6(f)).

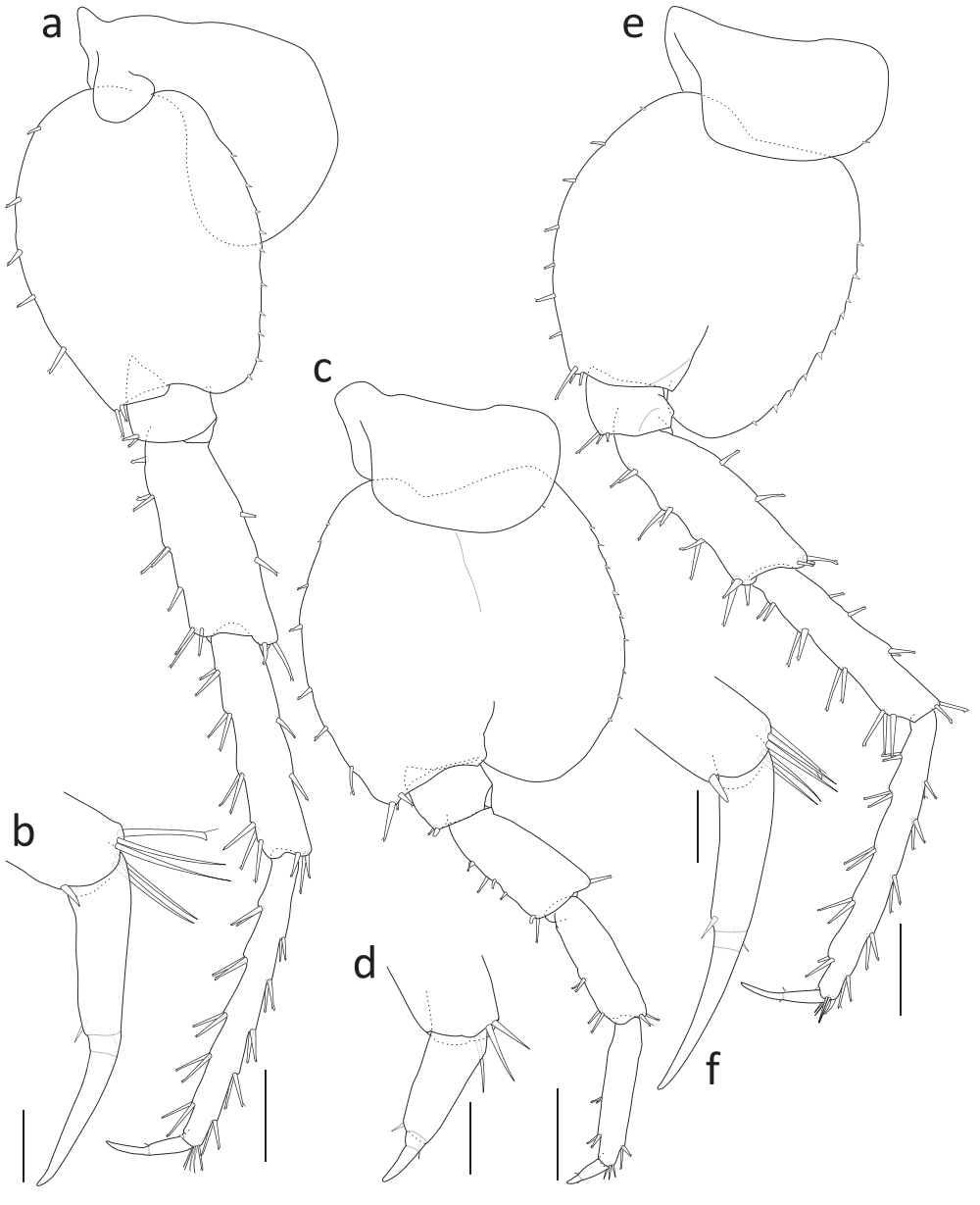


**Figure 7.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1 (a–d), paratype, male, NSMT-Cr 25804 (e, f). (a) Left pereopod 6, lateral view. (b) Dactylus of left pereopod 6, lateral view. (c) Left pereopod 7, lateral view. (d) Dactylus of left pereopod 7, lateral view. (e) Left pereopod 7, lateral view. (f) Dactylus of left pereopod 7, lateral view. Scale bars, 0.5 mm (a, c, e); 0.1 mm (b, d, f).

Pereopod 6 (Figure 7(a)): 1.5 times as long as pereopod 3; coxa bilobed, anterior lobe subrounded without seta, anterodistal corner of posterior lobe rounded, ventral margin of posterior lobe with 2 setae; basis elliptic, anterior margin with 5 robust setae, anterodistal corner with 2 robust setae, posterior margin slightly expanded and distally

weakly produced, with 10 simple setae; ischium quadrate, anterodistal corner with robust setae; merus to dactylus in length ratio of 1.0: 1.1: 1.4: 0.4, anterior margin of merus with 2 and 2 pairs of robust setae, anterodistal corner with 3 robust setae; posterior margin with 2 robust setae, posterodistal corner slightly produced, quadrate, with 3 robust setae; anterior margin of carpus with 4 pairs of robust setae and 1 robust seta, posterior margin with 2 robust setae, posterodistal corner with 3 robust setae; propodus slender, anterior margin with 5 pairs of robust setae, anterodistal corner with locking robust seta (Figure 7(b)), posterior margin with 5 pairs of robust setae, posterodistal corner with 1 robust seta and 2 pairs of simple slender setae; dactylus with 2 simple setae on base (Figure 7(b)).

Pereopod 7 of holotype (Figure 7(c)): almost as long as pereopod 3; coxa subquadrate, posterodistal margin with 1 seta; basis ovate, anterior margin with 2 simple and 5 robust setae, anterodistal corner with 3 robust setae, posterior margin expanded with 9 simple setae; ischium quadrate, anterodistal corner with 2 robust setae; merus to dactylus in length ratio of 1.0: 1.1: 1.2: 0.4, anterior margin of merus with at least 2 pairs of robust setae, anterodistal corner with 2 robust setae, posterior margin without seta, posterodistal corner with 1 robust seta; anterior margin of carpus with 2 pairs of robust setae, anterodistal corner lacking locking robust setae (Figure 7(d)), posterior margin without setae, posterodistal corner with 2 robust setae; anterior margin of propodus with 2 pairs of robust setae, posterior margin with 1 pair of robust setae, posterodistal corner with 3 simple slender setae; dactylus with 2 simple setae on base, unguis very short (Figure 7(d)).

Pereopod 7 of paratype (Figure 7(e)): 1.5 times as long as pereopod 3; coxa subquadrate, posterodistal margin with 1 seta; basis ovate, anterior margin with 1 simple and 6 robust setae, anterodistal corner with 3 robust setae, posterior margin expanded with 10 simple setae, posterodistally produced, exceeding distal joint of ischium; ischium quadrate, anterodistal corner with 3 robust setae; merus to dactylus in length ratio of 1.0: 1.1: 1.5: 0.4, anterior margin of merus with 3 pairs of robust setae, anterodistal corner with 3 robust setae, posterior margin with 2 robust setae, posterodistal corner slightly produced with 3 robust setae; anterior margin of carpus with 4 pairs of robust setae and 1 robust seta, posterior margin with 2 robust setae and 1 pair of robust setae, posterodistal corner quadrate with 2 robust setae; propodus slender, anterior margin with 5 pairs of robust setae, anterodistal corner with 1 locking robust seta (Figure 7(f)), posterior margin with 5 pairs of robust setae, posterodistal corner with 1 robust seta and 2 pairs of simple slender setae; dactylus with 2 simple setae on base (Figure 7(f)).

Coxal gills large, lobate, convoluted, those of gnathopod 2 and pereopod 3 smaller than those of pereopods 4–6 (Figure 8); coxal gill of gnathopod 2 consisting of at least 3 lobes, middle lobe largest (Figure 8(a)); posterior part of coxal gill of pereopod 3 with 2 small lobes (Figure 8(b)); anterior part of coxal gill of pereopod 4 slightly attenuated, posterior part consisting of 1 small attenuated lobe and 1 large and elongated lobe (Figure 8(c)); coxal gill of pereopod 5 consisting of at least 3 lobes, posterior lobe largest, posterior part with slender appendage (Figure 8(d)); coxal gill of pereopod 6 consisting of 3 lobes, middle lobe largest (Figure 8(e)).

Pleopods each with paired retinacula on inner margin of peduncle (Figure 9(a–f)); every ramus indistinctly articulate, with slender plumose setae (Figure 9(a), 9(c), 9(e)). Pleopod 1 (Figure 9(a)): peduncle bearing ~10 plumose setae on outer margin; inner

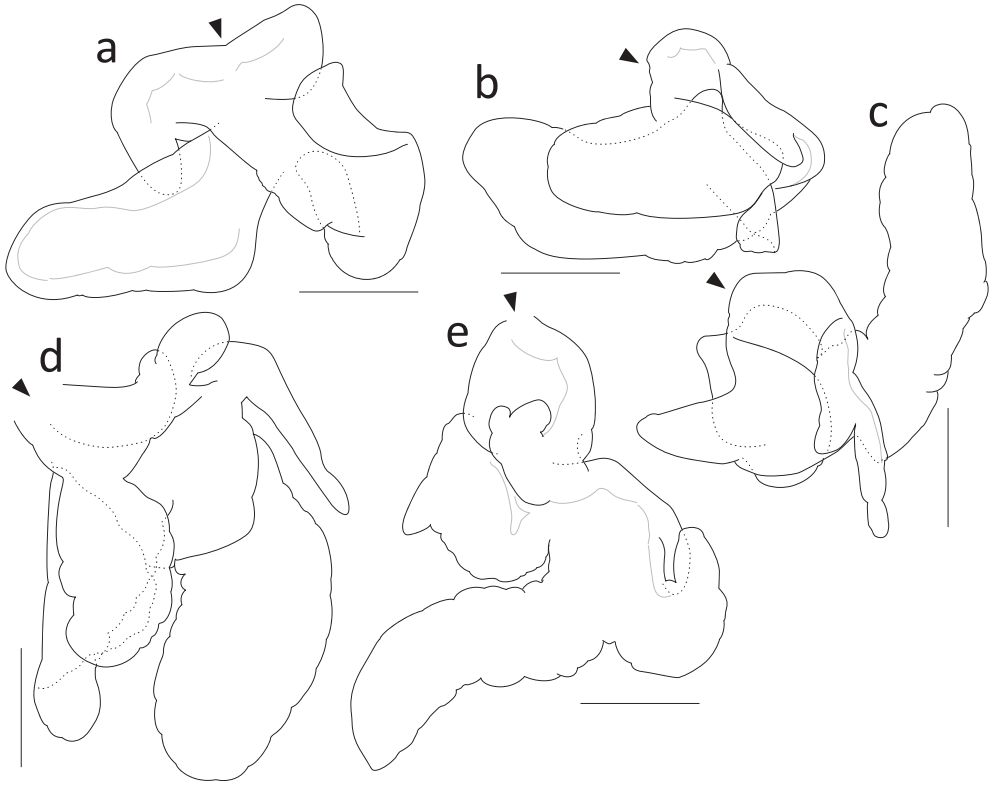


**Figure 8.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1. (a) Coxal gill of left gnathopod 2, lateral view. (b) Coxal gill of left pereopod 3, lateral view. (c) Coxal gill of left pereopod 4, lateral view. (d) Coxal gill of left pereopod 5, lateral view. (e) Coxal gill of left pereopod 5, lateral view. Black arrowheads indicate respective sites of coxal gill attachment. Scale bars, 0.5 mm.

ramus 1.1 times as long as peduncle; outer ramus 0.8 times as long as peduncle. Pleopod 2 (Figure 9(c)): 1.1 times as long as pleopod 1; peduncle bearing ~14 plumose setae on outer margin; inner ramus 1.1 times as long as peduncle; outer ramus 0.7 times as long as peduncle. Pleopod 3 (Figure 9(e)): 1.1 times as long as pleopod 1; peduncle bearing ~10 plumose setae on outer margin, and 5 simple setae on medial surface; inner ramus 1.1 times as long as peduncle; outer ramus 0.7 times as long as peduncle.

Uropod 1 (Figure 9(g)): peduncle with 2–3 robust plus 1–2 simple short, and 4 robust setae on inner and outer margins, respectively, inner distal corner with robust seta, outer distolateral robust seta 0.4 times as long as outer ramus; inner ramus 0.7 times as long as peduncle, inner margin with 4 robust setae, outer margin without setae, apical part with 4 robust setae; outer ramus 0.9 times as long as inner ramus, inner and outer margins without setae, apical part with 3–4 robust setae.

Uropod 2 (Figure 9(h)): 0.6 times as long as uropod 1; peduncle with 2 and 4 robust setae on inner and outer margins, respectively, outer distal corner with robust seta; inner ramus subequal to peduncle in length, with 5 robust setae on inner margin, outer

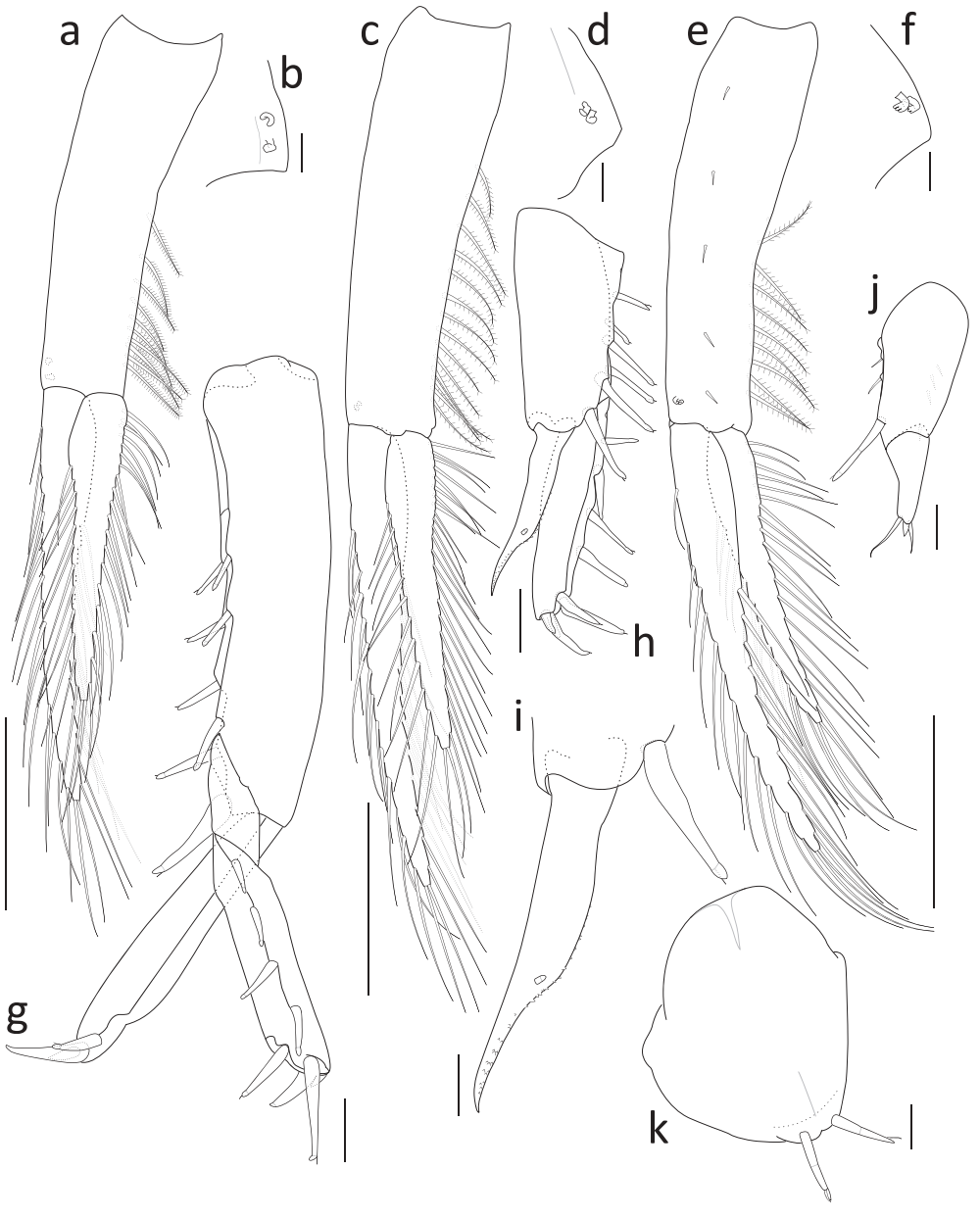


**Figure 9.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., holotype, male, IZCAS-I-A2591-1. (a) Left pleopod 1, anterior view. (b) Retinacula on peduncle of left pleopod 1, posterior view. (c) Left pleopod 2, anterior view. (d) Retinacula on peduncle of left pleopod 2, posterior view. (e) Right pleopod 3, posterior view. (f) Retinacula on peduncle of left pleopod 3, posterior view. (g) Left uropod 1, medial view. (h) Left uropod 2, lateral view. (i) Outer ramus of left uropod 2, lateral view. (j) Right uropod 3, lateroventral view. (k) Telson, dorsal view. All setae on pleopodous rami are plumose (a, c, e). Scale bars, 0.5 mm (a, c, e); 0.05 mm (b, d, f); 0.2 mm (g, h); 0.1 mm (i–k).

margin bare, apical part with 5 robust setae; outer ramus 0.8 times as long as inner ramus, distal part sinuate and narrowing sharply, bearing 1 small robust seta on

midlateral surface and a few rows of small teeth on middle to distal-dorsal surface (Figure 9(i)).

Uropod 3 subequal to telson in length (Figure 9(j)); peduncle with long robust seta, and a few simple setae on dorsal margin and medial surface; ramus 0.5 times as long as peduncle, with 2 slender and 1 robust setae apically.

Telson rhombic, longer than width, slightly cleft apically, medial suture on apical dorsal surface, 0.3 times as long as telson, with 1 apical robust seta per lobe (Figure 9(k)).

***Female [paratype, NSMT-Cr 25805].*** Antenna 1 (Figure 10(a)): 0.4 times as long as antenna 2, exceeding middle part of peduncular article 5 of antenna 2; peduncular articles in length ratio of 1.0: 0.9: 1.0; flagellum 7-articulate, 0.8 times as long as peduncle.

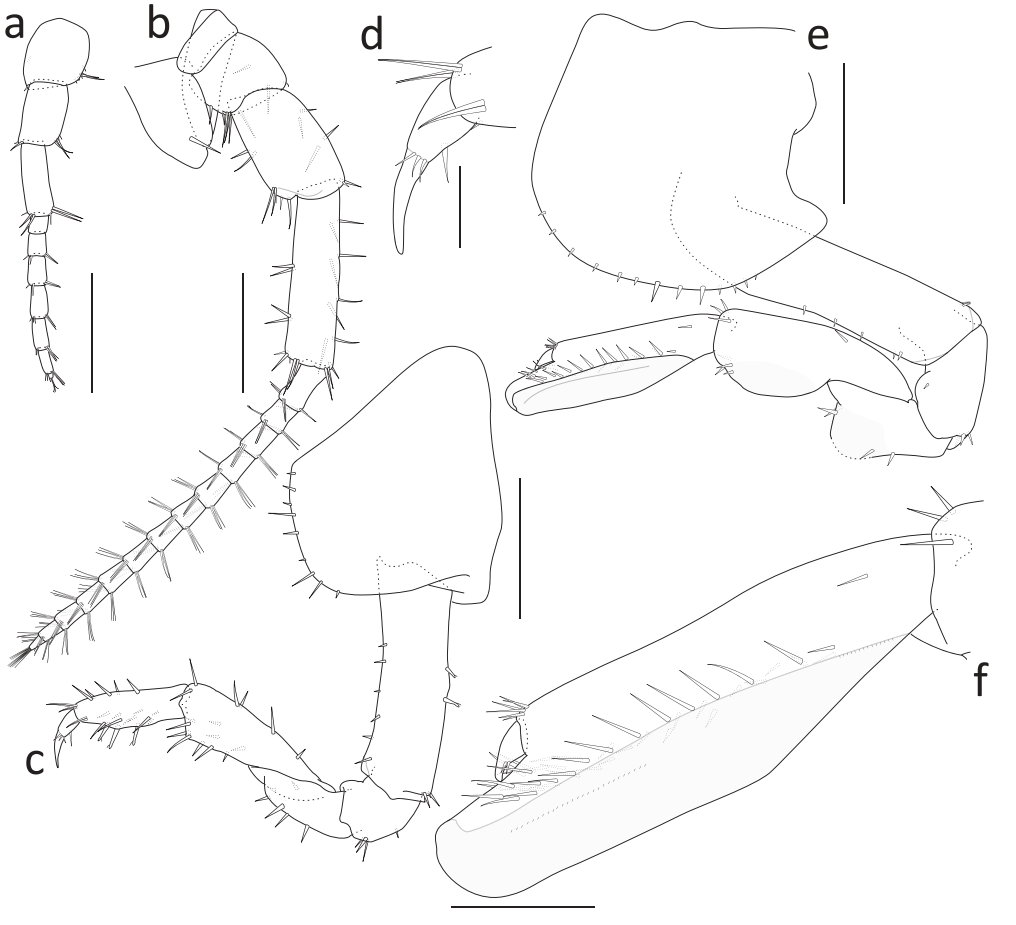


**Figure 10.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., paratype, female, NSMT-Cr 25805. (a) Left antenna 1, lateral view. (b) Right antenna 2, lateral view. (c) Left gnathopod 1, lateral view. (d) Dactylus of left gnathopod 1, lateral view. (e) Left gnathopod 2, lateral view. (f) Propodus and dactylus of left gnathopod 2, lateral view. Scale bars, 0.5 mm (a–c, e); 0.1 mm (d); 0.2 mm (f).

Antenna 2 (Figure 10(b)): 0.3 times as long as body length: peduncular articles robust, article 5 longest, subequal in length to articles 3 and 4 combined; flagellum 13-articles, length 0.8 times as long as peduncle, last article cone-shaped, forming virgula divina.

Buccal mass deep, height ca. 1.0 times as high as head.

Gnathopod 1 (Figure 10(c)): ventral margin of coxa with 9 simple setae; anterior and posterior margins of basis with simple and robust setae, respectively; ischium quadrate, posterodistal corner with 3 simple setae; merus with simple setae on posterior margin; carpus lacking pellucid lobe, 2.9 times as long as wide, anterior margin with a few slender setae, posterior margin with simple setae, each of anterodistal and posterodistal corners with simple setae; propodus slender and simple, 0.7 times as long as carpus, 3.0 times as long as wide, anterior margin with 1 simple seta and 2 pairs of simple setae, anterodistal corner with 2 pairs of simple setae, posterior margin with 3 robust setae and 1 simple seta, lateral surface with 2 submarginal robust setae; dactylus simple, 0.4 times as long as propodus, posterior margin with simple seta, hinge of unguis with 3 simple setae (Figure 10(d)).

Gnathopod 2 (Figure 10(e)): ventral margin of coxa with 13 simple setae, posterior cusp indistinct; anterior margin of basis with a few simple setae; ischium 0.9 times as long as merus; merus, posterodistal lobe present with scabrous surface; carpus 2.6 times as long as wide, developed posterodistal lobe with scabrous surface, anterodistal corner with 3 setae; propodus mitten-shaped, anterior margin parallel to posterior margin, 1.1 times as long as carpus, 3.6 times as long as wide, anterodistal corner with 6 simple setae, lateral and medial surfaces with more than 15 and more than 20 simple setae, respectively, posterior lobe produced, bearing scabrous surface (Figure 10(f)); dactylus much shorter than palmar margin, posterior margin with 2 simple setae (Figure 10(f)).

Oostegites on gnathopod 2 to pereopod 5, slender, with constant width in distal direction (Figure 11(a–d)); oostegite of pereopod 4 longest (Figure 11(c)); oostegite of pereopod 5 broadest (Figure 11(d)).

Uropod 2 (Figure 11(e)): 0.6 times as long as uropod 1; peduncle with 1 and 3 robust setae on inner and outer margins, respectively, outer distal corner with robust seta; inner ramus subequal to peduncle in length, with 3 robust setae on inner margin, outer margin bare, apical part with 5 robust setae; outer ramus 0.9 times as long as inner ramus, inner and outer margins without setae, apical part with 4 robust setae.

Uropod 3 (Figure 11(f)): 0.7 times as long as telson; peduncle with long robust seta, and a few simple setae on dorsal margin and medial surface; ramus 0.5 times as long as peduncle, with 1 slender simple and 1 robust setae apically.

### *Variation*

Epimeral plates 2 and 3 with 3 and 3–4 setae on posterior margins, respectively. Antenna 1 flagellum 5–7-articulate. Antenna 2 flagellum 10–14-articulate. Buccal mass ca. 0.8–1.2 times as high as head. Maxilliped palpal article 2 with 2–3 setae on outer margin, with 3–5 setae on inner submarginal part. Pereopod 6: anterodistal corner of posterior lobe of coxa subquadrate, ventral margin of posterior lobe of coxa with 3–5 setae. Each peduncle of pleopods 1–3 bearing 8–12, 10–15, and 7–12 plumose setae on outer margins, respectively; peduncle of pleopod 3 with 4–6 simple setae on medial surface. Uropod 1 peduncle with 2–4 robust plus 1–2 simple short, and 4 robust setae on inner and outer margins, respectively; inner ramus with 3–4 robust setae on inner margin.

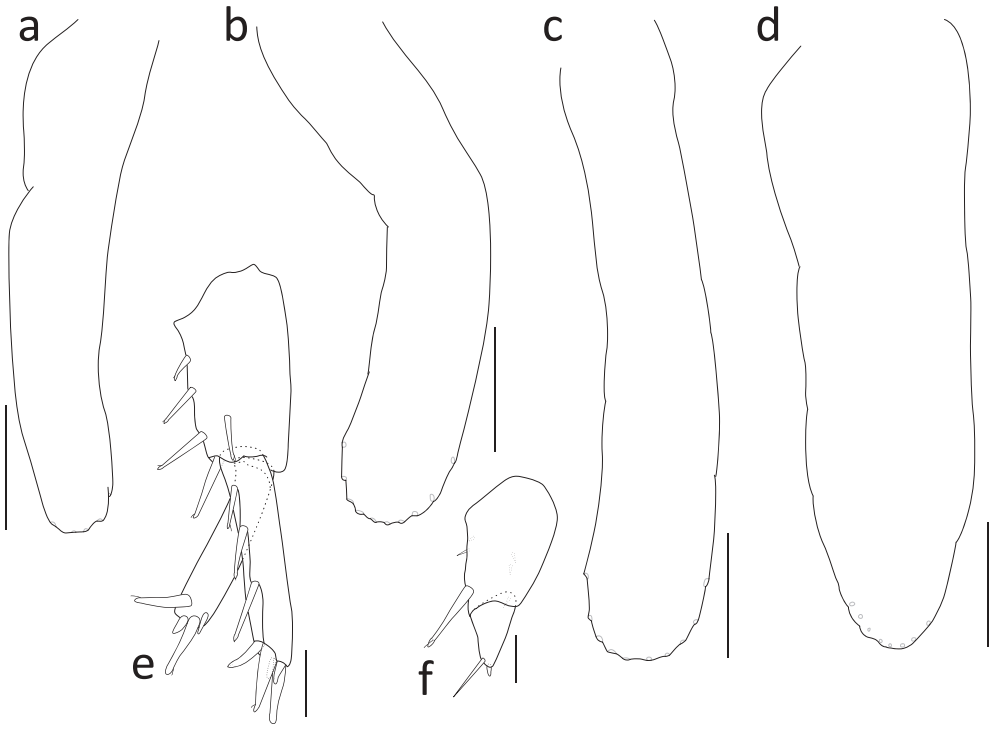


**Figure 11.** *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., paratype, female, NSMT-Cr 25805. (a) Oostegite of right gnathopod 2, medial view. (b) Oostegite of left pereopod 3, lateral view. (c) Oostegite of left pereopod 4, lateral view. (d) Oostegite of right pereopod 5, lateral view. (e) Left uropod 2, medial view. (f) Right uropod 3, lateroventral view. Scale bars, 0.2 mm (a–e); 0.1 mm (f).

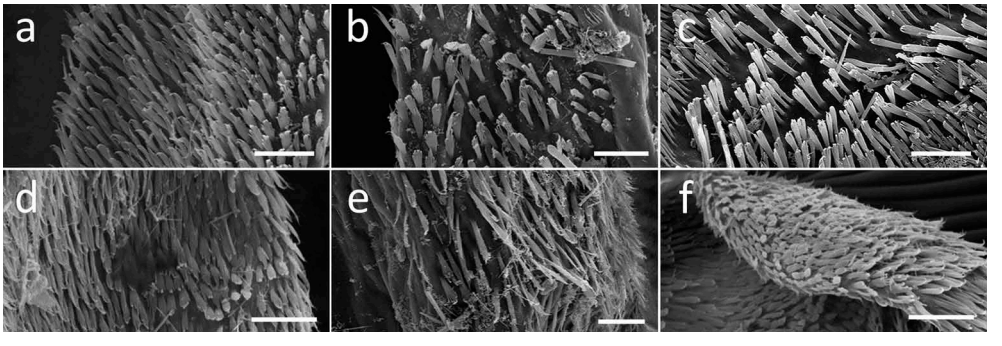


**Figure 12.** Scanning electron micrographs of right gnathopods 2 of *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov., paratype, male, NSMT-Cr 25804 (a–c), paratype, female, IZCAS-I-A2591-3 (d–f). (a) Palmate setae on posterodistal lobe of merus, medial view. (b) Palmate setae on posterodistal lobe of carpus, medial view. (c) Palmate setae on posterior lobe of propodus, medial view. (d) Palmate setae on posterodistal lobe of merus, medial view. (e) Palmate setae on posterodistal lobe of carpus, medial view. (f) Palmate setae on posterior lobe of propodus, medial view. Scale bars, 10 μm (a, b, d–f); 20 μm (c).

Male uropod 2 peduncle with 2 and 3 robust setae on inner and outer margins, respectively; inner ramus with 4 robust setae on inner margin. Female uropod 2 peduncle with 1 and 2–3 robust setae on inner and outer margins, respectively; inner ramus with 2–3 robust setae on inner margin. Telson: medial suture on apical dorsal surface, 0.2–0.4 times as long as telson.

### *SEM observation*

Scanning electron micrographs of gnathopods 1 and 2 of the respective male and female paratypes revealed that each of the posterodistal lobes of the merus (Figure 12(a), 12(d)) and carpus (Figure 12(b), 12(e)) as well as the posterior lobe of the propodus of gnathopod 2 (Figure 12(c), 12(f)) are covered with palmate setae in both specimens. Their gnathopods 1 do not bear palmate setae.

### *Natural history*

This species was found from leaf litter on the forest floor, not on the banks of streams or swamps (N. Nunomura, personal communication). The vegetation of the two collection sites was basically the same (see above), and represented a mixed mesophytic forest.

### *Etymology*

The specific name is a noun in the genitive case formed directly from the name of Mr Noboru Nunomura, who provided valuable specimens of this species.

### *Remarks*

The holotype possesses the undeveloped and short pereopods 7 on both sides (Figure 7(c)). The merus to propodus of each pereopod 7 lack robust setae on the respective posterior margins. Although the merus to propodus bears robust setae on the respective anterior margins, the setae are shorter than those of pereopod 7 of the male paratype (Figure 7(e)) as well as the female paratypes. Moreover, the holotype lacks a locking robust seta on the anterodistal corner of the propodus of pereopod 7 with a quite short dactylus compared with the other specimens. Accordingly, it is highly possible that the holotype bears the regenerated or deformed pereopods 7; at least the merus to dactylus of pereopod 7 shows undeveloped features.

In addition to the simplidactylate pereopods 3–7, the present talitrids clearly belong to *Myanmarorchestia* by the possession of the following characteristics defined by taxonomic studies (Hou and Zhao 2017; Zheng and Hou 2017): antenna 2 ca. 0.3 times as long as body length; left lacinia mobilis of mandible 4-dentate; maxilliped palp 4-articulate, palpal article 4 distinct bearing setae apically; gnathopod 1 of both sexes simple; gnathopod 2 sexually dimorphic, male propodus chelate and its posterior lobe produced anteriorly with scabrous surface, female propodus mitten-shaped with scabrous surface, each merus and carpus bearing posterodistal lobe with a scabrous surface in both sexes; coxal gills on gnathopod 2 to pereopod 6, large, lobate, convoluted; oostegites on gnathopod 2 to pereopod 5, generally slender; each ventral margin of epimeral plates 1–3 lacking slits; pleopods 1–3 well developed, all pleopods almost same in length, outer margins of peduncles of every pleopods bearing plumose setae; peduncle of uropod 1 with large outer distolateral robust seta, outer ramus with

bare margins; ramus of uropod 3 shorter than peduncle; telson distally subtriangular shaped, slightly cleft apically with 1 (rarely 2) apical robust seta per lobe.

The elongate antenna 1 reaching the middle part of the peduncular article 5 of antenna 2, the four-articulate maxilliped palp and the well-developed pleopods 1–3 of *M. nunomurai* obviously reject the possibility that this species belongs to *Solitroides*, which is the other high-montane landhopper genus indigenous to Indochina (Suzuki et al. 2017); the *Solitroides* species possesses the shorter antenna 1 reaching the distal part of the peduncular article 4 of antenna 2, the maxilliped palp of its article 4 coalescing with article 3, and the pleopod 3 that is wider and shorter than the other pleopods.

*Myanmarorchestia nunomurai* can be distinguished from *M. peterjaegeri* by the following characteristics (Hou and Zhao 2017): palp of maxilla 1 1-articulate (palp with small second article in *M. peterjaegeri*); coxal gills without filamentous projections (all coxal gills bearing filamentous projections); and telson with bare dorsal surface (dorsal surface notched). Additionally, male individuals of the present new species are distinguishable from males of *M. peterjaegeri* by the arcuate dactylus of gnathopod 2 (slightly curved), and the sexually dimorphic uropod 2, of which the distal part of the outer ramus is sinuate and narrowing sharply bearing a few rows of small teeth (without sexual dimorphism; distal part of outer ramus bearing robust setae).

The recently described *M. seabri* and *M. victoria* share the 1-articulate palp of maxilla 1, sexually dimorphic uropod 2, and the dorsally bare telson, although some males of *M. seabri* did not exhibit dimorphism in uropod 2 (Hou and Zhao 2017; Zheng and Hou 2017). *Myanmarorchestia nunomurai* differs from these two species by the following combination of the characteristics: palpal article 2 of maxilliped broad (narrow in *M. victoria*); coxa of gnathopod 1 produced proximally (anterior margin not produced in *M. victoria*); distinct posterior cusp of coxa of pereopod 4 (posterior cusp present, but undeveloped in *M. victoria*); all coxal gills on gnathopod 2 to pereopod 6 without filamentous projections (coxal gills on gnathopod 2 to pereopod 5 bearing filamentous projections in *M. seabri*; only coxal gill on gnathopod 2 with filamentous projections in *M. victoria*); and peduncle of uropod 3 bearing one long robust seta (two setae in *M. seabri*). While *M. nunomurai* possesses the sexually dimorphic uropod 2, the outer ramus of uropod 2 in the male of this new species bears a small robust seta on midlateral surface and a few rows of small teeth on the middle to distodorsal surface (a small robust seta on interior side along with small teeth only on distal surface in both *M. seabri* and *M. victoria*).

Although no DNA sequences, e.g. mitochondrial cytochrome *c* oxidase subunit I, have been determined for *M. nunomurai*, the aforementioned morphological traits of the new species clearly demonstrate its taxonomic status as being the fourth species of *Myanmarorchestia*. This is the first record of the landhopper genus *Myanmarorchestia* from a region other than Mt. Victoria of the Arakan Mountains. DNA sequences of *M. nunomurai* should be assessed based on the newly collected specimens in a future study. Additionally, inventory surveys and systematic studies of landhopper talitrids inhabiting high-montane regions in Indochina as well as southern China are essential to clarify the species diversity and evolutionary history of these amphipods.

## Key to species of Myanmarorchestia

1. Coxal gills on gnathopod 2 to pereopod 6 without filamentous projections ..... *Myanmarorchestia nunomurai* Nakano and Morino, sp. nov
   All/some coxal gills on gnathopod 2 to pereopod 6 with filamentous projections 2
2. Palp of maxilla 1 with small second article; telson with small notches on dorsal surface ..... *Myanmarorchestia peterjaegeri* Hou in Hou and Zhao, 2017
   Palp of maxilla 1 1-articulate; telson with bare dorsal surface ..... 3
3. Article 2 of maxilliped palp broad; peduncle of uropod 3 bearing 2 long robust setae ..... ..... *Myanmarorchestia seabri* Hou in Hou and Zhao, 2017
   Article 2 of maxilliped palp narrow; peduncle of uropod 3 bearing 1 long robust seta ..... ..... *Myanmarorchestia victoria* Hou in Zheng and Hou, 2017

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## Disclosure statement

No potential conflict of interest was reported by the authors.

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## Geolocation information

IZCAS-I-A2591-1–3, NSMT-Cr 25804, 25805 (point): 25.17°N, 98.34°E

## ORCID

Takafumi Nakano http://orcid.org/0000-0001-6107-2188
Ko Tomikawa http://orcid.org/0000-0003-1521-9016
Zhonge Hou http://orcid.org/0000-0001-5929-1154

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