

Description of a New Land-hopper Genus, *Kokuborchestia* gen. nov. and Redescription of *K. kokuboi* (Uéno, 1929) comb. nov. (Crustacea, Amphipoda, Talitridae)

Hiroshi Morino¹ and Hisashi Miyamoto²

¹ Department of Zoology, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba, Ibaraki 305–0005, Japan
E-mail: morino631@gmail.com

² 4–9 Kasumi, Maruoka-cho, Sakai, Fukui 910–0231, Japan
E-mail: dream_5000000690737@yahoo.co.jp

(Received 20 May 2015; accepted 24 June 2015)

Abstract *Kokuborchestia* gen. nov. is described and the type species, *K. kokuboi* (Uéno, 1929) comb. nov. is redescribed. This genus is characterized by elongate antenna 1 reaching mid-point of peduncular article 5 of antenna 2, 4- or 5- dentate lacinia on left mandible, maxilliped palp article 2 mediodistally lobate, palp article 4 reduced but distinct, gnathopod 1 (both sexes) deeply subchelate, pereopods cuspidactylate, pleopods with densely plumose setose peduncles and developed rami, uropod 1 outer ramus marginally robust setose. Several land-hopper genera from Japan and adjacent regions show similarity to this new genus in gnathopod 1 and maxilliped. However, elongate antenna 1, plumose setose peduncles and develop rami of pleopods, marginally robust-setose outer ramus of uropod 1 are unique to the genus among them. The new genus also displays similar features to *Cochinorchestia* Lowry and Peart, 2010 and “*Parorchestia*” *gowerensis* Bousfield, 1976 from south oceans. Though, well-developed maxilliped palp 4 in *Cochinorchestia* and reduced outer rami on pleopods in “*P.*” *gowerensis* are distinctive to each genus. This species occurs in coastal land habitats in restricted areas in the northwest Pacific.

Key words: Crustacea, land-hoppers, *Kokuborchestia kokuboi*, new genus, new combination, Talitridae.

Introduction

Orchestia kokuboi was described by Uéno (1929) based on specimens secured on a hill of a small island (Yu-no-shima) off Asamushi, northern tip of Honshu, Japan. After that, Iwasa (1939) described females of a talitrid species under the name of *O. kokuboi* on the basis of material collected from Mt. Haruka, near Sapporo, Hokkaido. In the revision on the north Pacific talitrids, Bousfield (1982) proposed to restrict the concept of *Orchestia* to shore-dwelling and immediate coastal-terrestrial species of the Atlantic-Mediterranean region, though he did not indicate the generic allocation of *Orchestia kokuboi*. Quite recently Lowry and Fanini (2013)

redefined *Orchestia* further and confined it to marine supralittoral species, where they critically reviewed the world “*Orchestia*” species and noted the possibility of “*Orchestia*” *kokuboi* belonging to *Paciforchestia* Bousfield, 1982. Morino and Miyamoto (2015b) amended the concept of *Paciforchestia* and alluded to the features of “*Orchestia*” *kobukoi* in comparison with *Paciforchestia*. Thus so far the generic position of “*Orchestia*” *kokuboi* has not been formally established. This is partly because the original description was not adequate in modern sense and also description (and figures) of female specimens given by Iwasa (1939) are not consistent with the original description in essential characters. Unfortunately the type specimens of “*O.*”

kokuboi are not available (most probably lost), so that in this paper, the specimens from a nearest place to the type locality are redescribed, and a new genus is erected to accept this species since it displays features distinctive from other genera.

Methods

The general methodology follows Morino (2014). The specimens were dissected under a stereomicroscope, and appendages and bodies were depicted under a light microscope using a drawing tube. The illustrated appendages were fixed on slide mounts with Hoyer's medium or kept in tubes with bodies. The body length measured from the tip of head to the tip of telson along straightened dorsal margin. In the description of species, generic characters are basically not repeated. The specimens studied are lodged in the collection of the National Museum of Nature and Science, Tsukuba (NSMT), or in the private collection of Miyamoto.

Taxonomy

Family Talitridae

Kokuborchestia gen. nov.

[New Japanese name:

Kokubo-okatobimushi zoku]

Type species. *Orchestia kokuboi* Uéno, 1929

Diagnosis. Body size medium large, eyes medium large. Antenna 1 elongate, exceeding mid-point of peduncular article 5 of antenna 2; peduncle subequal to flagellum in length, peduncular article 3 longer than articles 1 and 2 each. Antenna 2 in male not incrassate, flagellum longer than peduncle. Mandible, left lacinia 4- or 5-dentate. Maxilliped, precoxa outer margin not stepped, palp articles 2 and 3 broad, mediodistally lobate, article 4 reduced but distinct, apically positioned on article 3.

Gnathopod 1 in both sexes deeply subchelate, merus-propodus with pellucid lobe (weaker in female), carpus and propodus with broad based

one; propodus lateral surface with a row of elongate robust setae. Gnathopod 2 in male, propodus powerfully subchelate; in female, basis slightly expanded anteriorly, propodus mitten-shaped. Pereopods 3–7 cuspidactylate (bi-cusperate), dactyli locking robust setae lacking or weakly developed. Coxa of pereopod 4 as deep as wide. Coxa of pereopod 6, posterior lobe smoothly curved anteroventrally. Pereopods 6 and 7 in male not incrassate. Coxal gills of pereopods 2 and 6 large, gill of pereopod 6 broad and truncated distally. Oostegites with simple-tipped setae mid-distally.

Pleopods, peduncles outer margin densely plumose-setose, with 2 retinacula; rami developed. Uropod 1, peduncle distolateral robust seta shorter than subdistal one; inner ramus with dorsomarginal and outer marginal robust setae; outer ramus with marginal robust setae. Uropod 3, peduncle dorsally expanded; ramus attenuate. Telson lobe with lateral, laterodistal and distal robust setae group (1–3 setae per group).

Remarks. *Kokuborchestia* gen. nov. is characterized by densely plumose-setose peduncles on pleopods and distally truncated coxal gill on pereopod 6. However, in other several characters the new genus shows similarity to several terrestrial or supralittoral genera worldwide. Deeply subchelate gnathopod 1 (both sexes) with pellucid lobes on carpus-propodus (weak in female), maxilliped palp article 2 broad with distinct mediodistal lobe, article 4 reduced but distinct, and cuspidactylate pereopods in the new genus are shared with the following genera in the North Pacific: *Paciforchestia* Bousfield, 1982, from the North-east Pacific, *Pyatakoveestia* Morino and Miyamoto, 2015b, from the North-west Pacific, *Nipponorchestia* Morino and Miyamoto, 2015a, from Japan, *Bousfieldia* Chou and Lee 1996, from Taiwan and adjacent islands, and *Lanorchestia* Miyamoto and Morino, 2010, from Lanyu Island, Taiwan. *Paciforchestia* sense of Morino and Miyamoto, 2015b is separable from *Kokuborchestia* by antenna 1 not reaching mid-point of peduncular article 5 of antenna 2, moderately reduced pleopod rami, 3 + retinacula on

pleopod peduncle, peduncle of uropod 1 with elongate distolateral robust seta, *etc.*; *Pyatakoveestia* is by stepped outer margin on maxilliped precoxa, strongly reduced pleopod rami, elongate telson, *etc.*; *Nipponorchestia* is by antenna 1 not reaching mid-point of peduncular article 5 of antenna 2, weak pellucid lobe on female gnathopod 1, moderately reduced pleopod rami, and uropod 1 with elongate distolateral robust seta on peduncle and marginally bare outer ramus, *etc.* The new genus is closer to *Bousfieldia* in having developed pleopod rami and also to *Lanorchestia* in having elongate antenna 1 (reaching end of peduncular article 5 of antenna 2). However, both genera are separable from the new genus by uropod 1 with elongate distolateral robust seta and marginally bare outer ramus. In addition, *Bousfieldia* is distinguished from *Kokuborchestia* in having antenna 1 not reaching mid-point of peduncular article 5 of antenna 2, female gnathopod 1 with weak or lacking pellucid lobe; *Lanorchestia* is in having moderately reduced pleopod rami.

Kokuborchestia also shows similarity to a few taxa from the southern oceans. *Cochinorchestia* Lowry and Peart 2010, from southern India and Moçanbique, is allied to the genus in having elongate antenna 1, maxilliped palp article 2 with mediodistal lobe, and deeply subchelate (to chelate) gnathopod 1 (merus-propodus with pellucid lobe), pleopods well developed, uropod 1 outer ramus marginally robust setose. However, well-developed palp article 4 of maxilliped, telson with apical setae (lacking lateral robust setae) of *Cochinorchestia* differentiate this genus from *Kokuborchestia*.

"*Parorchestia*" *gowerensis* Bousfield, 1976, from Lord Howe Island, off Australia, displays several similar characters to the new genus in antenna 1 (exceeding beyond end of peduncular article 4 of antenna 2), maxilliped palp articles 2 mediodistally lobate and article 4 reduced but distinct, merus-propodus of male gnathopod 1 with pellucid lobe, pleopods peduncle plumose setose (though not dense), outer ramus of uropod 1 with marginal robust setae. However, strongly

slender and elongate antenna 2 and pereopods, female gnathopod 1 with weak pellucid lobe, distally attenuate coxal gill of pereopod 6, fewer plumose setae on pleopod peduncles, reduced outer ramus of pleopods, and elongate distolateral robust seta on uropod 1 are features distinctive to this species. The cusps of pereopod dactyli are not known for "*P.*" *gowerensis*. The generic allocation of this species is better to await the study of types.

Etymology. The generic name is a combination of the specific name of the type species and *Orchestia*.

Kokuborchestia kokuboi (Uéno, 1929) comb. nov.

[Japanese name: Kokubo-okatobimushi]

(Figs. 1–3)

Orchestia kokuboi Uéno, 1929: 7, text-fig. 1; Iwasa, 1939: 266, text-fig. 9, pl. XII; Bulycheva, 1957: 163, fig. 59. "*Orchestia kokuboi*: Morino, 2015: 1087, 1076 (fig. 2).

Material examined. HOKKAIDO: 2 males, 1 ovig. female, 2 females (NSMT-Cr 24097); Kumoishi, Kumaishi-cho, Hiyama; 31 Jul. 1984; Otaka, A. collect. 9 males, 3 ovig. females, 13 females (NSMT-Cr 24099); Tomarigawa, Mt. Obira, Shimamaki-gun; 8 Aug. 1986; Udagawa, T. collect. Male 13.0 mm (NSMT-Cr 24092), female 14.4 mm (NSMT-Cr 24093), 3 males, 2 females, 1 juvenile (NSMT-Cr 24094); Fukushima, Matsumae-gun; 29 Sept. 1979; Kato, H. collect. 1 male, 1 female, 3 juveniles (NSMT-Cr 24095); Shiriuchi River, Matsumae-gun; 21 Sept. 1980; Ando, A. collect. Male 11.0 mm (NSMT-Cr 24101), 2 males, 2 females, 1 unsexed (NSMT-Cr 24102); Mt. Hakodate, Hakodate; 26 May 1994; Tsubokura, T. collect.

AOMORI: 1 male, 1 ovig. female, 2 females (NSMT-Cr 24089); Wakinozawa (*Cryptomeria* forest near sea-shore), Shimokita-gun; 4 Sept. 1974; Morino, H. collect. 2 males, 6 females, 1 juvenile (NSMT-Cr 24098); Wakinozawa, Shimokita-gun; 13 Dec. 1986; Yanagihashi collect. 3 males, 1 ovig. female, 1 female (NSMT-

Cr 24091); Shimofuro, Shimokita-gun; 12 Aug. 1979; Kato, H. collect. 1 male, 4 females (NSMT-Cr 24090); Mimmaya, Tsugaru-gun; 26 Sept. 1979; Kato, H. collect. 5 males, 2 females (NSMT-Cr 24100); Juniko Lakes (forest near Ketoba pond), Nishitsugaru-gun; 16 Nov. 1991; Otaka, A. collect. 5 males, 2 females (NSMT-Cr 24106); Juniko Lakes (near Ketoba pond); Nishitsugaru-gun; 24 Apr. 1999; Otaka, A. collect. Male 13.9 mm (NSMT-Cr 24103), male 16.0 mm (NSMT-Cr 24123), female 15.9 mm (NSMT-Cr 24104), female 12.5 mm (NSMT-Cr 24122), 5 males, 9 females, 2 juveniles (NSMT-Cr 24105); hill behind Asamushi Marine Station (Tohoku University), Asamushi; 7 Oct. 1977; Morino, H. collect. Male 20 mm, female 16 mm (Miyamoto collection); Asamushi Marine Station (Tohoku University); 8 Jul. 1978; Miyamoto H. collect. 23 males, 32 females (Miyamoto collec-

tion); Yu-no-shima Island (forest floor), Asamushi; 8 Jul. 1978; Miyamoto, H. collect. 1 female (NSMT-Cr 24096); Asamushi; 16 Jun. 1983; Nunomura, N. collect. 3 males, 5 females (Miyamoto collection); Azigasawa (forest on slope); Nishitsugaru-gun; 8 Aug. 1978; Miyamoto, H. collect. 3 males, 3 females (Miyamoto collection); Obata (*Cryptomeria* forest, upstream of Nakamura River), Azigasawa, Nishitsugaru-gun; 8 Aug. 1978; Miyamoto, H. collect.

Description of male (NSMT-Cr 24103, 13.9 mm). Eyes medium large, subround. Antenna 1 (Fig. 1B), peduncular article 3 longest, flagellum as long as peduncle, with 7 articles. Antenna 2 (Fig. 1A), peduncular article 5 subequal to articles 3 and 4 combined, flagellum longer than peduncle, with 17 articles. Upper lip (Fig. 1C) lacking robust setae. Mandible (Fig. 1E), left lacinia 4-dentate. Maxilliped (Fig.

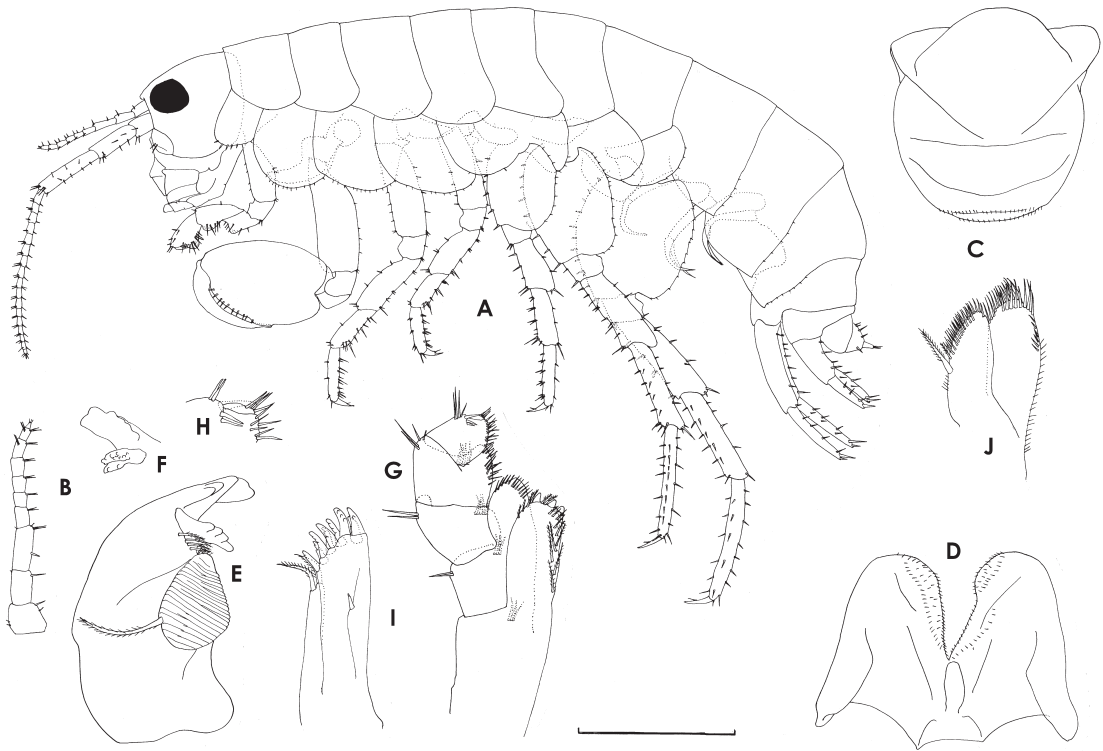


Fig. 1. *Kokuborchestia kokuboi* (Uéno, 1929) comb. nov. Male, 13.9 mm (NSMT-Cr 24103). Asamushi, Japan. —A, habitus, lateral view (after Morino, 2015); B, antenna 1; C, upper lip; D, lower lip; E, left mandible; F, distal part of right mandible; G, maxilliped; H, palp article 4 of maxilliped; I, maxilla 1; J, maxilla 2. Scale: A, 2.50 mm; B, 1.43 mm; C–G, I–J, 0.42 mm; H, 0.14 mm.

1G–H), palp article 4 reduced, distinct, positioned apically. Other mouth parts (Fig. 1D, F, I–J), same as those of other talitrid species.

Gnathopod 1 (Figs. 1A, 2A), carpus *ca.* 1.2 times as long as propodus, propodus lateral surface with row of 6 submarginal elongate setae, palmar margin vertical, exceeding dactylus. Gnathopod 2 (Figs. 1A, 2B), propodus palmar margin smooth, slightly shorter than posterior margin, dactylus attenuate apically. Pereopod 4 shorter than pereopod 3 (Fig. 1A), propodi of both pereopods lacking locking robust setae (Fig. 2F–G), dactylus of pereopod 4 pinched. Pereopods 5–7, propodi locking robust setae minute (Fig. 2H–J). Coxal gill of pereopod 2 (Fig. 2K), lobed at middle, those of pereopods 3–5 (Fig. 2L–N) smaller, convoluted, coxal gill of pereopod

pod 6 (Fig. 2O) as large as that of pereopod 2, distal half broad and truncated distally.

Pleonite side plates (Fig. 2Q), posterodistal corner angulate, with several setules on posterior margin, lacking marginal pits. Pleopods 1–3 (Fig. 2R–T), peduncles with facial fine robust setae, and with dense plumose-setae on whole outer margin, bearing 2 retinacula; rami developed, (0.92, 0.88, 0.89 times as long as respective peduncle, with about 13 articles.

Uropod 1 (Fig. 3D), inner ramus with 3 dorso-marginal, 3 outer marginal robust setae, outer ramus with 3 marginal robust setae. Uropod 2 (Fig. 3E), both rami subequal in length, with marginal and apical robust setae. Uropod 3 (Fig. 3F), peduncle with 3 robust setae, rami shorter than peduncle (*ca.* 0.6 times), with marginal and

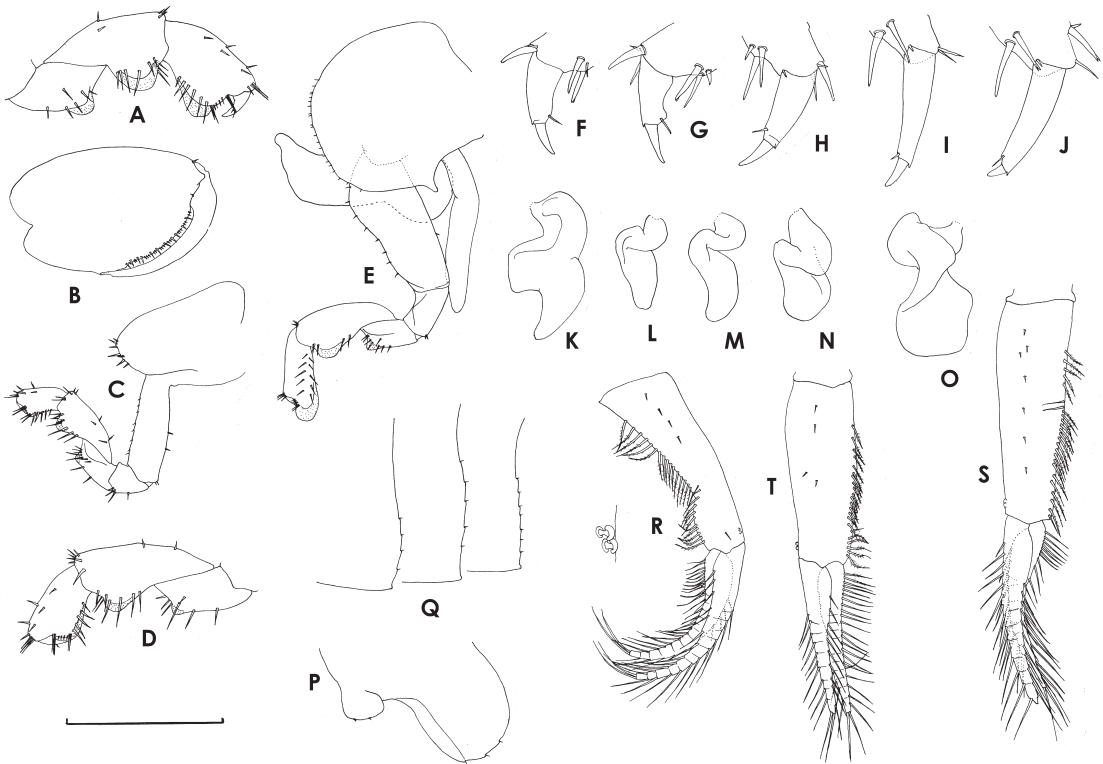


Fig. 2. *Kokuborchestia kokuboi* (Uéno, 1929) comb. nov. A–B, F–T, male, 13.9 mm (NSMT-Cr 24103); C–E, female, 15.9 mm (NSMT-Cr 24104). Asamushi, Japan.—A, distal articles of gnathopod 1; B, distal articles of gnathopod 2; C, gnathopod 1; D, distal articles of gnathopod 1; E, gnathopod 2; F–J, distal articles of pereopods 3–7; K–O, coxal gills of pereopods 2–7; P, coxal plate of pereopod 6; Q, pleonite side plates; R–T, pleopods 1–3 with enlarged retinacula. Scale: A, D, 0.94 mm; B–C, E, K–O, 1.61 mm; F–J, 0.48 mm; P–Q, 1.43 mm; R–T, 0.71 mm.

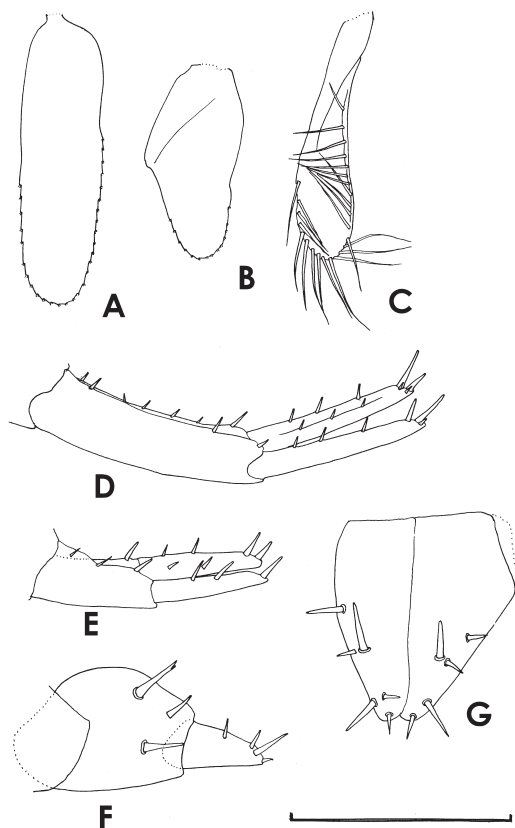


Fig. 3. *Kokuborchestia kokuboi* (Uéno, 1929) comb. nov. A–B, female, 15.9 mm (NSMT-Cr 24104); C, female, 12.5 mm (NSMT-Cr 24122); D–G, male, 13.9 mm (NSMT-Cr 24103). Asamushi, Japan. A–B, oostegites of pereopods 2 and 5; C, oostegite of pereopod 2; D–F, uropods 1–3; G, telson. Scale: A–E, 1.43 mm; F–G, 0.56 mm.

apical robust setae. Telson (Fig. 3G) with dorsal longitudinal suture, bearing 5–6 robust setae per lobe.

Female (sexual characters NSMT-Cr 24104, 15.9 mm; NSMT-Cr 24122, 12.5 mm). Gnathopod 1 (Fig. 2C–D), pellucid lobes on merus-propodus distinct but weaker than of those of male, carpus *ca.* 1.7 times as long as propodus, with row of 5 submarginal elongate setae on lateral surface, palmar margin vertical, slightly exceeding dactylus. Gnathopod 2 (Fig. 2E) basis antero-proximally slightly expanded, merus and carpus with dome-shaped pellucid lobe, propodus lateral surface with rows of facial and submarginal

setae. Oostegite of pereopod 2 (Fig. 3A, C) with 25, that of pereopod 5 (Fig. 3B) with 14 simple-tipped setae.

Distribution. *Kokuborchestia kokuboi* has been collected from coastal forests (see also Tsubokura *et al.* 1998), occasionally from inland forests, in southwestern Hokkaido, and northern tip of Honshu (Fig. 4). Most sites face the Tsugaru Strait. Gongalsky *et al.* (2014) recorded this species from broad-leaved forests in Kunashir Island, Kuril Islands.

Remarks. The present material displays no distinct inconsistencies with the original description. Females from Mt. Haruka, near Sapporo, Hokkaido, of which Iwasa (1939) gave illustration, exhibit same features as types and the present material, except 5-dentate left lacinia on mandible and marginally bare peduncles on pleopods. Close examination of additional material at hand reveals that a specimen from Mt. Hakodate, Hokkaido (NSMT-Cr 24101) bears 5-dentate lacinia. Also in some specimens the plumose setae on the pleopod peduncles tightly adhered to the peduncles and were hard to recognize. Thus, it is concluded that *Kokuborchestia kokuboi* has 4-, occasionally 5-, dentate left lacinia. And it is highly probable that Iwasa (1939) has failed to recognize the plumose setae on pleopods.

In Japan, this species occurs on a restricted area on the coasts of Honshu and Hokkaido, facing the Tsugaru Strait. The strait is known as Blakiston Line, a zoogeographical barrier line for terrestrial animals between Honshu and Hokkaido. Geologically the strait is estimated to have been bridged during the glacial periods, 10 to several 10 thousands years before. Two hypotheses are possible to explain the pattern of this distribution: due to dispersal by rafting between Hokkaido and Honshu, or reflecting the ancient pattern since the time of land bridge. Recently Gongalsky *et al.* (2014) reported this species as a component of soil fauna characteristic to broad-leaved forests in Kunashir Island, Kuril, Russia. It is possible that future studies expand the distributional range in these areas. In any case, *K. kokuboi* exhibits spotted-pattern of



Fig. 4. Distribution of *Kokuborchestia kokuboi* (Uéno, 1929) comb. nov. in the Japan Archipelago. Star marks are from Iwasa (1939) and Gongalsky *et al.* (2014).

geographical distribution and peculiar morphological features, which might suggest that the endemism of this species is of paleoendemic.

Acknowledgments

We sincerely thank Mr. Kato, H., Dr. Otaka, A. and colleagues who kindly forwarded their sam-

ples for this study. Dr. Komatsu, H. of the National Museum of Nature and Science has supported us in preparing the manuscript, to whom we are grateful. We also thank Dr. Lowry, J. K. for careful reading and valuable comment on an earlier draft.

References

- Bousfield, E. L. 1976. A new terrestrial amphipod from Lord Howe Island. *Records of the Australian Museum*, 30: 118–122.
- Bousfield, E. L. 1982. The amphipod superfamily Talitroidea in the northeastern Pacific region. 1. Family Talitridae: systematics and distributional ecology. *Publications in Biological Oceanography*, 11: i–vii, 1–72.
- Bulycheva, A. I. 1957. Morskie bloxi morej SSSR i sopredel'nyx vod (Amphipoda - Talitroidea). *Opredeliteli po Faune SSSR, Akademiya Nauk SSSR*, 65: 1–185. (In Russian.)
- Chou, W.-H. and J.-D. Lee 1996. A new terrestrial amphipod (Crustacea) from a subtropical forest in Taiwan, with description of a new genus. *Bulletin of the National Museum of Natural Science*, 8: 43–55.
- Gongalsky, K. B., D. M. Kuznetsova, A. D. Elagin, S. A. Malyavin and A. S. Zaitsev. 2014. Soil macrofauna of the south of Kunashir Island (Kuril Islands, Russia). *Doklady Biological Sciences*, 457: 240–243.
- Iwasa, M. 1939. Japanese Talitridae. *Journal of the Faculty of Science, Hokkaido Imperial University, Series 6, Zoology*, 6: 255–296, pls. 9–18.
- Lowry, J. K. and L. Fanini 2013. Substrate dependent talitrid amphipods from fragmented beaches on the north coast of Crete (Crustacea, Amphipoda, Talitridae), including a redefinition of the genus *Orchestia* and descriptions of *Orchestia xylyno* sp. nov. and *Cryptorchestia* gen. nov. *Zootaxa*, 3709: 201–229.
- Lowry, J. K. and R. Peart 2010. The genus *Microorchestia* (Amphipoda: Talitridae) in eastern Australia. *Zootaxa* 2349: 21–38.
- Miyamoto, H. and H. Morino 2010. Taxonomic studies on the Talitridae (Crustacea: Amphipoda) of Taiwan. IV. The genera *Paciforchestia* and *Lanorchestia* gen. nov. *Species Diversity*, 15: 155–167.
- Morino, H. 2014. A new land-hopper genus, *Mizuhorchestia*, from Japan (Crustacea, Amphipoda, Talitridae). *Bulletin of the National Museum of Nature and Science, Series A (Zoology)*, 40: 117–127.
- Morino, H. 2015. Amphipoda. In Aoki, J. (ed.): *Pictorial Keys to Soil Animals of Japan*, 2nd ed, pp. 1069–1089. Tokai University Press, Hadano. (In Japanese.)
- Morino, H. and H. Miyamoto 2015a. A new land-hopper genus, *Nipponorchestia*, with two new species from Japan (Crustacea, Amphipoda, Talitridae). *Bulletin of the National Museum of Nature and Science, Series A (Zoology)*, 41: 1–13.
- Morino, H. and H. Miyamoto 2015b. Redefinition of *Paciforchestia* Bousfield, 1982 and description of *Pyatakoveestia* gen. nov. (Crustacea, Amphipoda, Talitridae). *Bulletin of the National Museum of Nature and Science, Series A (Zoology)*, 41: 105–121.
- Tsubokura, T., S. Kikuchi and S. Nakano 1998. Distribution pattern, gill area relationships, and fine structural characteristics of the gill epithelia in supralittoral and terrestrial talitrid amphipods. *Journal of Crustacean Biology*, 18: 625–642.
- Uéno, M. 1929. A new terrestrial amphipod *Orchestia kokuboi*, sp. nov. from Asamushi. *Science Reports of the Tôhoku Imperial University, Fourth series, Biology*, 4: 7–9.