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Redefinition of *Paciforchestia* Bousfield, 1982 and description of *Pyatakovestia* gen. nov. (Crustacea, Amphipoda, Talitridae)

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Abstract *Paciforchestia* Bousfield, 1982 is redefined to receive solely the type species, *P. klawei* (Bousfield, 1961), and *Pyatakovestia* gen. nov. is erected to accommodate the two species previously assigned to *Paciforchestia* sensu lato and two new species from Japan: *P. pyatakovi* (Derzhavin, 1937), *P. gageoensis* (Kim and Min, 2013), *P. iwasai* gen. et sp. nov. and *P. boninensis* gen. et sp. nov. *Paciforchestia* sensu stricto is characterized by having: elongate antenna 1, 5-dentate lacinia on left mandible, mediodistally lobate palp article 2 on maxilliped, deeply subchelate gnathopod 1 (both sexes), cuspidactylate pereopods, moderately reduced pleopods with 3 + retinacula, elongate dorsolateral robust seta of peduncle and marginally robust-setose outer ramus on uropod 1. *Pyatakovestia* gen. nov., inhabiting supralittoral zones to coastal and mountain forests in Japan, is distinguished from *Paciforchestia* sensu stricto by the stepped outer margin on maxilliped precoxa, deep coxae, strongly reduced pleopod rami, and distally truncated (or rounded) urosomite 3. Three species within *Pyatakovestia*: *P. gageoensis*, *P. iwasai* and *P. boninensis*, are characterized by having marginally bare outer ramus on uropod 1. *Pyatakovestia gageoensis* is peculiar in having inflated dactyli on pereopods 3–5; *P. boninensis* in having strongly robust-setose margin of both rami on uropod 2.

Key words: Amphipoda, Talitridae, *Paciforchestia*, *Pyatakovestia iwasai*, *Pyatakovestia boninensis*, new genus, new species.

Introduction

Paciforchestia has been established by Bousfield (1982) as a plesiomorphic North Pacific beach flea genus, with the type species of *Parorchestia klawei* Bousfield, 1961 from the east Pacific and an additional species, *Paciforchetia pyatakovi* (Derzhavin, 1937) from the west Pacific.[1)] In his paper, several character differences between *P. klawei* and *P. pyatakovi* were pointed out and subgeneric ranking for each species was suggested. After that, the generic concept has been discussed by Miyamoto and Morino (2010) and additional species have been reported from the north Pacific: Morino (2015) reported two undescribed species from Japan, Miyamoto and Morino (2010) recorded a species of this genus from Taiwan, though the latter could not be identified to species due to poor condition of the specimen. From Korea, Kim and Min (2011) reported the occurrence of *P. pyatakovi* and Kim and Min (2013) described *P. gageoensis*. These West Pacific species show high similarity among each other as compared

[1)] Bousfield (1982) listed *P. tenuimana* (Iwasa, 1939) as a third species but it is relegated to a junior synonym of *P. pyatakovi* (see Miyamoto and Morino, 2010).

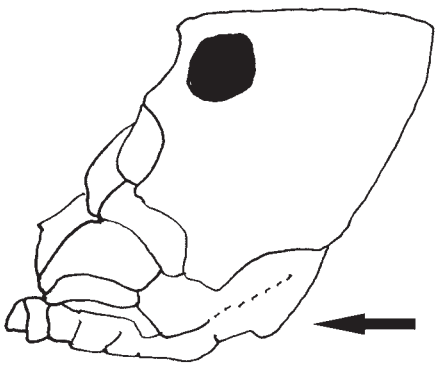

Fig. 1. Head with stepped outer margin of maxilliped precoxa (arrow) in *Pyatakovestia pyatakovi*.

between the West Pacific species group and *P. klawei*. In addition, the member of the West Pacific species group shares a peculiar stepped structure on the outer margin of "precoxa" on maxilliped (Fig. 1). This structure is situated on a plate which is basal to the coxa of maxilliped and preceeds the sternite 1. In this paper, the plate is tentatively named as precoxa. This stepped character state seems apomorphic since to our present knowledge no other talitrid species have ever exhibited it. These similarity patterns reasonably validate the original suggestion of Bousfield's, and in this paper the West Pacific species group is separated from the genus *Paciforchestia* and promoted to independent generic rank. The new narrow concept of *Paciforchestia* is proposed and the two undescribed species from Japan are described under the new genus.

Methods

The specimens were dissected under a stereomicroscope, then 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. The bodies were transferred in tubes. 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. For the description of a second species, the same state of characters as in the first species are not basically repeated, though all parts are illustrated in figures. The specimens studied are lodged in the collection of the National Museum of Nature and Science, Tsukuba (NSMT). In the study of the genus *Pyatakovestia*, co-types of *Orchestia marquesana* Stephensen, 1935, loaned from the Zoologisk Museum Denmark, were examined for comparison.

Taxonomy

Family Talitridae

Paciforchestia Bousfield, 1982, amend.

Paciforchestia Bousfield, 1982: 17 (partim); Miyamoto and Morino, 2010: 156 (partim); Kim and Min, 2011: 123 (partim).

Type species. *Parorchestia klawei* Bousfield, 1961.

Diagnosis. Body medium-large. Coxae of pereopods 2–4 shallower than depth of respective pereonite. Urosomite 3 distally narrowed in lateral view. Eyes medium. Antenna 1, exceeding end of peduncular article 4 of antenna 2, peduncle longer than flagellum; peduncular article 3 longest. Antenna 2 in male not incrassate; flagellum longer than peduncle. Mandible, left lacinia 5-dentate. Maxilliped, outer margin of precoxa smooth, palp articles 2 and 3 broad, article 2 mediodistally lobate, article 4 reduced, distinct. Gnathopod 1 in both sexes deeply subchelate, merus with pellucid lobe (feeble or lacking in female), carpus and propodus with broad based pellucid lobe, propodus lateral surface with row of elongate setae. Gnathopod 2 in male, propodus powerfully subchelate; in female basis weakly expanded anteriorly, propodus mitten-shaped. Pereopods cuspidactylate (bi-cuspate), propodus locking spines developed. Pereopods 6, 7 in male, not incrassate. Coxa of pereopod 4 wider than deep. Coxa of pereopod 6, posterior lobe smoothly curved anteroventrally. Coxal gill of pereopod 6 convoluted, as long as that of pereopod 2. Pleopods, peduncle marginally bare or weakly robust-setose, with 3 or more retinacula; rami moderately reduced, with 3 or more

articles. Uropod 1, peduncle distolateral robust seta longer than subdistal one; both rami with marginal robust setae. Uropod 3, peduncle expanded at middle, ramus narrowing distally. Telson longer than wide, smoothly attenuate, with lateral and apical robust setae. Oostegites whole-marginally simple-setose.

Remarks. *Paciforchestia klawei*, distributed in the supralittoral zones of the East Pacific (from British Colombia to Mexico) composes this genus in the present concept. *Paciforchestia* is allied to *Nipponorchestia* Morino and Miyamoto, 2015, described from terrestrial habitats from Japan, in having elongate antenna 1, mediodistally lobate article 2 and reduced article 4 on the palp of maxilliped, deeply subchelate (both sexes) and pellucid-lobed merus-propodus (male) in gnathopod 1, moderately reduced pleopods, and elongate distolateral robust seta on uropod 1. However, *Nipponorchestia* has 4-dentate lacinia on left mandible, female gnathopod 1 lacking pellucid lobe on propodus, and marginally bare outer ramus on uropod 1. *Traskorchestia* Bousfield, 1982 also shows similarity to *Paciforchestia* in gnathopod 1 and maxilliped, though short distolateral robust seta on the peduncle of uropod 1 and curl-tipped setae on oostegites in *Traskorchestia* distinguish this genus from *Paciforchestia*.

As has been suggested by Bousfield (1982) and Lowry and Fanini (2013), "*Orchestia*" *kokuboi* Uéno, 1929, described from a hill of a small island in northern-most Honshu (Aomori Prefecture), exhibits several similar features to *Paciforchestia*: medium sized eyes, mediodistally lobate palp article 2 of maxilliped, deeply subchelate gnathopod 1 in both sexes, marginally robust-setose outer ramus of uropod 1, expanded peduncle of uropod 3, arrangement of robust setae on telson. However, more elongate antenna 1 (reaching mid-point of peduncular article 5 of antenna 2), 4-dentate lacinia of left mandible, pleopod peduncles with 2 retinacula and dense plumose setae, and short distolateral robust seta on peduncle of uropod 1 in "*O.*" *kokuboi* distinguish from *Paciforchestia*.

"*Parorchestia*" *gowerensis* Bousfield, 1976, described from Lord Howe Island (among damp moss), off Australia, exhibits similar features to *Paciforchestia*: elongate antennae 1 and 2, lobate palp article 2 of maxilliped, deeply subchelate gnathopod 1 (both sexes), moderately reduced pleopod rami (outer rami), and uropod 1 with elongate distolateral robust seta and marginally robust-setose outer ramus. However, 4-dentate lacinia of left mandible, pleopod peduncles with 2 retinacula and plumose setae, smoothly attenuate peduncle of uropod 3, and telson as long as wide, of "*P.*" *gowerensis* separate from *Paciforchestia*.

Paciforchestia klawei (Bousfield, 1961)

Parorchestia klawei Bousfield, 1961: 3, figs. 1–2; Bousfield, 1982: 18, fig. 8.

Material examined. 2 females (11.4 mm, 11.5 mm) and 1 male (14.0 mm) (NSMT-Cr 23954); Ocean Beach, San Diego, California, USA; 1956; Klawe, W. L. collect.

Remarks. This species is diagnosed by the generic definition given above. The habitats and geographical distribution are documented in detail by Bousfield (1982): it occurs on the Pacific coast of North America, under drift debris on the beaches from British Columbia to Los Coronados (Mexico).

Pyatakovestia gen. nov.

[Japanese name: Hosohamatobimushi zoku]

Type species. *Orchestia pyatakovi* Derzhavin, 1937.

Additional species. *Paciforchestia gageoensis* Kim and Min, 2013; *Pyatakovestia iwasai* sp. nov.; *Pyatakovestia boninensis* sp. nov.

Diagnosis. Body large, eyes small to medium. Coxae of pereopods 2–4 large and deeper than respective pereonite. Urosomite 3 distally truncated (or rounded). Antenna 1, peduncle exceeding end of peduncular article 4 of antenna 2; peduncle longer than flagellum,

peduncular article 3 longest, flagellum medial article longest; antenna 2 in male, not incrassate; flagellum distinctly longer than peduncle. Mandible, left lacinia 5-dentate. Maxilliped, outer margin of precoxa stepped, palp articles 2 and 3 broad and mediodistally lobate, article 4 reduced, distinct, subapically positioned. Gnathopod 1 (both sexes) deeply subchelate, merus with pellucid lobe, carpus and propodus with broad based pellucid lobes, propodus lateral surface with row of elongate robust setae. Gnathopod 2, male propodus powerfully subchelate; in female, basis anteroproximally expanded, propodus mitten-shaped. Pereopods cuspidactylate (bi-cuspate), propodus locking spines variously developed. Pereopods 6 and 7 in male not incrassate. Coxa of pereopod 4 deeper than wide, trapezoidal. Coxa of pereopod 6, posterior lobe smoothly curved. Coxal gill of pereopod 6 slender, smoothly curved, longer than that of pereopod 2. Pleopod peduncles bare or weakly robust-setose, with 2 retinacula; rami strongly reduced. Uropod 1, peduncle distolateral robust seta longer than subdistal one; outer ramus marginally bare or robust-setose. Uropod 3, peduncle strongly expanded, ramus slender. Telson longer than wide, narrowing distally, dorsal suture running longitudinally, with apical robust-setae. Oostegites mid-distally or distally simple-setose.

Remarks. Members of *Pyatakovestia* gen. nov. are very similar to each other, sharing many features. This genus is clearly distinguished from *Paciforchestia* by the following characters among others: maxilliped (outer margin of precoxa stepped), urosomite 3 (distally truncated or rounded), flagellar article of antenna 1 (third article from the ultimate longest), antenna 2 (flagellum distinctly longer than peduncle), female gnathopod 2 (basis expanded anteroproximally), coxae of pereopods 2–4 (deep), pleopods (peduncle with 2 retinacula; rami strongly reduced), uropod 3 (peduncle strongly expanded), telson (longer than wide and with apical robust-setae only). Land hopper genera distributed along and adjacent to the Japanese Archipelago, namely *Bousfieldia* Chou and Lee, 1996, *Lanorchestia* Miyamoto and Morino, 2010 and *Nipponorchestia* Morino and Miyamoto, 2015, also display deeply subchelate gnathopod 1 (both sexes), mediodistally lobate palp article 2 of maxilliped palp, moderately reduced pleopods (except *Bousfieldia*), and elongate distolateral robust seta on uropod 1. However these genera have 4-dentate lacinia on left mandible (*vs.* 5-dentate) and the combination of the above-mentioned features for *Pyatakovestia* clearly distinguish from them.

"*Parorchestia*" *marquesana* Stephensen, 1935, described from the Marquesas Islands (altitude up to 4000 feet; female) displays similar features to *Pyatakovestia*: elongate antennae 1, 2, and pereopods; truncated urosomite 3; male gnathopod 1 with deeply subchelate propodus and the merus-propodus bearing pellucid lobes; female gnathopod 2 with anteroproximally expanded basis; strongly reduced pleopod rami with 1 article; and the armature of uropod 1. However, smooth precoxa of maxilliped, 4-dentate lacinia of left mandible (co-type), female gnathopod 1 with shallowly subchelate propodus which lacks pellucid lobe on distal articles, apically cleft telson, among others, separate this species from the genus *Pyatakovestia*. Shoemaker (1942) redescribed "*P.*" *marquesana* (male and female) from Clipperton Island (a coral atoll of Mexico). However, larger eyes, short but convexed palm of female gnathopod 1, tapering urosomite 3, deep apical notch on telson of the Clipperton material suggest different species (see also Lowry and Fanini, 2013).

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

Key to species of *Pyatakovestia*

1. Uropod 1, outer ramus with 3–4 marginal robust setae. ..... *pyatakovi* (Derzhavin, 1937)
   Uropod 1, outer ramus marginally bare. 2

2. Dactyli of pereopods 3–5 inflated, bearing fine setae dorsally; ventral margin of anterior lobe on coxa of pereopod 5 with a seta. ..... *gageoensis* (Kim and Min, 2013)
   Dactyli of pereopods 3–5 smoothly attenuate, lacking fine setae dorsally; ventral margin of anterior lobe on coxa of pereopod 5 with several setae. 3
3. Uropod 2, outer ramus with 2–3 marginal robust setae; inner ramus with 3–4 dorsomarginal and 1 (rarely 2) outer marginal robust setae. ..... *iwasai* sp. nov.
   Uropod 2, outer ramus with 5–6 marginal robust setae; inner ramus with 4–6 dorsomarginal and 3–5 outer marginal robust setae. ..... *boninensis* sp. nov.

Pyatakovestia pyatakovi (Derzhavin, 1937)

[Japanese name: Hosohamatobimushi]
(Fig. 2)

Orchestia pyatakovi Derzhavin, 1937: 91, tab. 2, fig. 1; Gurjanova, 1951: 805, fig. 560; Bulycheva, 1957: 172, fig. 62; Morino, 1975: 180, text-figs. 8–11.

Orchestia tenuimana Iwasa, 1939: 268, figs. 10–11, plate 13; Stephensen, 1944: 63, figs. 20–21.

Paciforchestia pyatakovi: Bousfield, 1982: 17 (key); Kim and Min, 2011, 124, figs. 2–6; Morino, 2015: 1079 (fig. 2), 1087.

Non *Paciforchestia tenuimana*: Bousfield, 1982, 17 (key).

Material examined. HOKKAIDO: 10 females, 26 juveniles (incl. hatchlings) (NSMT-Cr 23956); Oshoro Bay (pebbles shore), Yoichi; 19 Jun. 1971; Morino, H. collect. 1 male, 3 females, 11 juveniles (incl. hatchlings) (NSMT-Cr 23957); near Akkeshi Marine Station (Hokkaido University) (pebbles shore with stranded algae), Akkeshi; 21 Jun. 1971; Morino, H. collect. 1 male 17.7 mm (NSMT-Cr 23958), 1 female (NSMT-Cr 23959), 2 males, 30 females, 15 juveniles (NSMT-Cr 23960); near Muroran Marine Station (Hokkaido University) (supralittoral), Muroran; 25 Jun. 1971; Morino, H. collect. 1 male, 1 ovig. female (NSMT-Cr 23968); Usujiri, Kameda Peninsula; 26 Jun. 1979; Hiwatari, T. collect. 1 male, 1 ovig. female, 1 unsexed (NSMT-Cr 23974); Oshima-oshima Island (grassland on a cliff), Matsumae; 2–6 Aug. 1988; Kitano, S. collect. 1 male, 1 female (NSMT-Cr 23976); Atsuta (supralittoral, nearby a small stream); Ishikari Bay; 23 Jul. 1990; Kyono, M. collect.

AOMORI: 1 male 16.5 mm (NSMT-Cr 23961), 1 female 12.5 mm (NSMT-Cr 23962), 50 males, 8 females (incl. ovig. females), 35 juveniles (incl. hatchlings) (NSMT-Cr 23963); Shirane-zaki (pebbles shore with stranded algae); Asamushi; 26 Jun. 1971; Morino, H. collect. 2 males (NSMT-Cr 24052); Yushima, Asamushi; 7 Aug. 1978; Miyamoto, H. collect.

AKITA: 2 males, 12 females, 5 juveniles (NSMT-Cr 23955); Shiohama (pebbles shore with stranded algae), Toga Bay, Oga; 16 Jun. 1971, Morino, H. collect.

IWATE: 1 female (NSMT-Cr 23973); Coastal Research Center (Tokyo University) (on a rocky cliff), Akahama, Otsuchi; 26 Jun. 1987; Morino, H. collect.

NIIGATA: 1 male, 1 female (NSMT-Cr 24053); Sashiwa, Aikawa-cho, Sado Island; 9 Oct. 1977; Miyamoto, H. collect. 3 males, 1 female (NSMT-Cr 24054); Ogi, Sado Island; 10 Oct. 1977; Miyamoto, H. collect.

ISHIKAWA: 5 males, 2 juveniles (NSMT-Cr 24046); Notojima Island, Noto Peninsula; 20 Aug. 1982; Miyamoto, H. collect. 2 males, 2 females (NSMT-Cr 24049); Sosogi, Noto Peninsula; 9 Aug. 1982; Miyamoto, H. collect. 4 males, 1 female (NSMT-Cr 24051); Kashima Shrine (forest), Kaga; 9 Jul. 1982; Miyamoto, H. collect.

TOYAMA: 11 males, 19 females (NSMT-Cr 23964); Fushiki; 18 Oct. 1970; Yoshii, R. collect.

FUKUI: 7 males, 3 females (NSMT-Cr 23972); Kaji, Mikuni, Sakai; 13 Dec. 1986; Miyamoto, H. collect. 2 males (NSMT-Cr 24045); Inumi, Oi-cho; 5 Jun. 1977; Miyamoto, H. collect. 2 males (NSMT-Cr 24047); Yamanaka (sea shore), Uchiura Bay; 21 Aug. 1977; Miyamoto, H. collect. 1 male (NSMT-Cr 24048); Sekumi, Mikata-gun; 7 Oct. 1978; Miyamoto, H. collect. 8 males, 1 female (NSMT-Cr 24050);

Fig. 2. Distribution of *Pyatakovestia pyatakovi* (Derzhavin, 1937) around the Japan Archipelago. ★: from references.

Kaji (Echizen-matsushima); 13 Dec. 1986; Miyamoto, H. collect. 3 males, 6 females (NSMT-Cr 24055); Kaji (Echizen-matsushima); 12 Feb. 1975; Miyamoto, H. collect.

KYOTO: 1 male 17.0 mm, (NSMT-Cr 23965), 1 female 12.5 mm, (NSMT-Cr 23966), 8 males, 10 females, 10 juveniles (NMST-Cr 23967); Jajima Island (pebbles shore with stranded matter), Maizuru Bay; 19 Nov. 1972; Morino, H. collect.

SHIMANE: 1 male (NSMT-Cr 23969); Maji (coastal forest), Nima-cho; 3 Nov. 1982; Nunomura, N. collect. 4 males, 6 juveniles (NSMT-Cr 24043); Nishinoshima, Oki; 4 Aug. 1978; Miyamoto, H. collect.

NAGASAKI: 3 males, 4 females (NSMT-Cr 23970); Kechi, Mitsushima, Tsushima Island; 12 Oct. 1986; Nunomura, N. collect. 1 male (NSMT-Cr 23971); Iguchi Bay, Kami-agata, Tsushima Island; 12 Oct. 1986; Nunomura, N. collect. 1 juvenile (NSMT-Cr 23975); Kuwa, Izuhara, Shimo-agata, Tsushima Island; 5 Jul. 1988; Nunomura, N. collect. 1 female, 1 larvae-gerous female, 4 juveniles (NSMT-Cr 24044); Toyotama-cho, Tshusima Island; 3 Aug. 1983; Miyamoto, H. collect.

Distribution. This species occurs in most cases from pebbles shores of the supralittoral zone, especially under wrack beds (Morino, 1975; Kim and Min, 2011, present study). Geographical distribution ranges from Kuril (Bulycheva, 1957) to central Japan along the Pacific, while further to south-west Japan along the Japan Sea coast (Fig. 2). The occurrence on the Pacific coast is rare and sporadic as compared with rich and continuous distribution on the Japan Sea coast.

Remarks. After the original description on the basis of the material from the Russian coast of the Japan Sea (Derzhavin, 1937), this species has been described based on materials from several localities of the North-west Pacific: Russian coast of Japan Sea (Bulycheva, 1957), Hokkaido (Japan Sea coast) (Iwasa, 1939), northern Honshu, Japan (Morino, 1975), central Honshu, Japan (Pacific coast) (Stephensen, 1944), and South Korea (Kim and Min, 2011). These descriptions well accord with each other, and also with the material of the present study. The key to the species presents the diagnosis of this species. This species occurs most northerly within this genus.

It should be noted that the northern coasts of Fukui Prefecture, which had harbored rich populations of *P. pyatakovi*, suffered heavily from oil spillage by the accident of a Russian oil tanker in January, 1997. Since then it is very difficult to find specimens of this species. All the material from this area in the present study was collected before the accident.

Pyatakovestia gageoensis **(Kim and Min, 2013)**

(Fig. 3)

Paciforchestia gageoensis Kim and Min, 2013: 27, figs 3–11.

Distribution. This species occurs on the supralittoral zones, mainly of gravel, and usually found under rotting seaweed (Kim and Min, 2013). It has been collected from two islands of South Korea: Gageodo and Chujado Islands (Fig. 3, after Kim and Min, 2013).

Remarks. For the diagnosis of this species see the key given above. The habitat of this species is detailed in Kim and Min (2013), and is very similar to that of *P. pyatakovi*. It is possible that this species has invaded inland and some populations inhabit the coastal grassland and forests of those islands.

Pyatakovestia iwasai sp. nov.

[Japanese name: Minami-hosohamatobimushi]

(Figs. 4–7)

Paciforchestia sp. 2: Morino, 2015: 1080 (fig. 2), 1088.

Type material. Holotype (NSMT-Cr 24007), male 17.4 mm; Hiraiso (pebbles shore), Nakaminato, IBARAKI; Jun. 1981; Morino, H. collect. Allotype (NSMT-Cr 24008), female 16.7 mm; same data as holotype. Paratypes: male 15.9 mm (NSMT-Cr24009); same data as holotype; ovig. female 16.2 mm (NSMT-Cr 24010); same data as holotype. Ovig. female 14.1 mm (NSMT-Cr 24012); near Yagazi Bridge (pebbles shore with litter), Yagazi Island, OKINAWA; 22 May 1978; Morino, H. collect. Male 11.1 mm (NSMT-Cr 24013); same data as the previous paratype.

Additional material examined. IBARAKI: 1 female, 1 ovig. female, 1 juvenile (NSMT-Cr 23991); Ubano-futokoro (the shore reclaimed now), Nakaminato; 6 May 1971; Inoue, H. collect. 3 males, 1 female (NSMT-Cr 24004); Isohama, Nakaminato; 5 Feb. 1971; Inoue, H. collect. 29 males, 31 females, 6 ovig. females, 4 juveniles (NSMT-Cr 24011); Hiraiso, Nakaminato; Jun. 1981; Morino, H. collect. 1 male, 1 female (NSMT-Cr 24056); Oarai; 10 May 1979; Miyamoto, H. collect.

CHIBA: 2 males, 1 female, 8 juveniles, 1 unsexed (NSMT-Cr 23995); Tainoura (grassland of backshore), Amatsu-Kominato; 22 Oct. 1975; Morino, H. collect. 26 juveniles (NSMT-Cr 23997); Tainoura, Amatsu-Kominato; 12 Jun. 1975; Komeda, S. collect. 4 males, 9 females, 1 ovig. female, 83 juveniles (NSMT-Cr 23998); Amatsu-Kominato (pebbles shore); 8 Jun. 1975; Komeda, S. collect. 1 male, 38 juveniles (NSMT-Cr 23999); Amatsu-Kominato (under stranded algae on high tide zones); 9 Jun. 1975; Komeda,

Fig. 3. Distribution of *Pyatakovestia gageoensis* (Kim and Min, 2013) from Kim and Min (2013).

S. collect. 6 males, 4 females, 1 juvenile (NSMT-Cr 24000); near Marine Station (Chiba University) (coastal grassland); 14 Jun. 1976; Morino, H. collect. 4 males, 2 females, 11 juveniles (NSMT-Cr 24003); Amatsu-Kominato (on high tide mark); 22 Jan. 1978; Ushiroda, T. collect. 5 males, 4 females, 2 ovig. females, 12 juveniles (NSMT-Cr 24006); near Marine Station (Chiba University) (coastal grassland with bushes), Amatsu-Kominato; 12 Jun. 1980; Morino, H. collect. 3 juveniles (NSMT-Cr 24025); Banda (coastal grassland), Tateyama; 12 Jun. 1987; Morino, H. collect. 3 males, 2 juveniles (NSMT-Cr 24027); Iwafune (coastal grassland), Oharacho; 30 Jun. 1995; Morino, H. collect. 7 males, 12 juveniles (NSMT-Cr 24028); Ajiro Bay (under litter of pebbles shore), Onjuku; 30 Jun. 1995; Morino, H. collect. 1 male, 1 female, 2 juveniles (NSMT-Cr 24029); Ajiro Bay (under stranded algae of pebbles shore), Onjuku; 30 Jun. 1995; Morino, H. collect. 7 males, 1 female, 3 juveniles (NSMT-Cr 24030); Tainoura (coastal grassland of *Miscanthus sinensis*), Amatsu-Kominato; 19 Oct. 1996; Morino, H. collect. 3 males, 2 females, 1 ovig. female (NSMT-Cr 24031); near Osawa Fishing Port (base of coastal cliff, stranded matter), Katsu-ura; 19 Oct. 1996; Morino, H. collect. 5 males, 10 females, 14 juve-

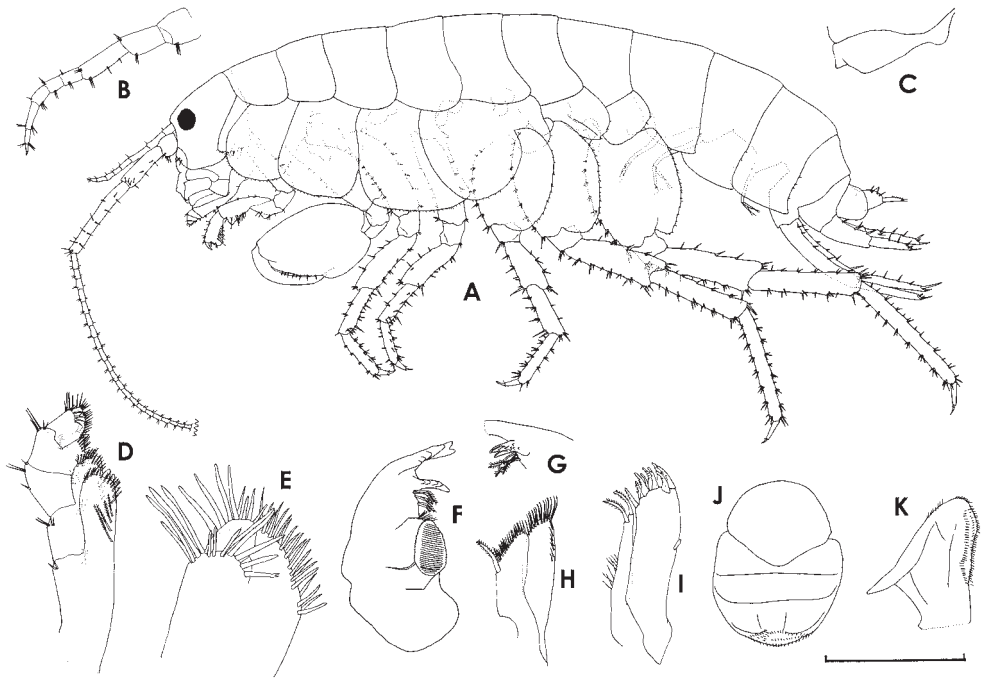

Fig. 4. *Pyatakovestia iwasai* gen. et sp. nov. Male, 17.4 mm (holotype, NMST-Cr 24007). Hiraiso, Ibaraki, Japan. — A, habitus, lateral view (after Morino, 2015); B, antenna 1; C, maxilliped precoxa; D, maxilliped; E, palp article 4 of maxilliped; F, left mandible; G, lacinia of right mandible; H, maxilla 2; I, maxilla 1; J, upper lip; K, left lobe of lower lip. Scale: A, 3.22 mm; B, 1.61 mm; C, 1.43 mm; D, F–K, 0.63 mm; E, 0.15 mm.

niles (NSMT-Cr 24032); Moriya (backshore, pebbles), Katsu-ura; 20 Oct. 1996; Morino, H. collect. 2 males, 1 juvenile (NSMT-Cr 24033); Moriya (backshore, *Miscanthus sinensis*), Katsu-ura; 20 Oct. 1996; Morino, H. collect. 3 males, 5 females, 4 juveniles (NSMT-Cr 24034); Ubara (pebbles shore), Katsu-ura; 20 Oct. 1996; Morino, H. collect. 1 male (NSMT-Cr 24035); Inubozaki, Choshi; 18 Apr. 1998; Nunomura, N. collect. 7 males, 2 females (NSMT-Cr 24036); Hama-namegawa (supralittoral zone and coastal forest), Katsu-ura; 28 Aug. 1999; Nunomura, N. collect. 4 males, 1 female and 1 ovig. female, 3 juveniles (NSMT-Cr 24040); west of "Flower Park" (backshore, grassland), Kamogawa; 15 May 1998; Morino, H. collect. 5 males, 3 females, 1 juvenile (NSMT-Cr 24041); west of "Flower Park" (pebbles shore, stranded *Sargassum*), Kamogawa; 15 May 1998; Morino, H. collect. 2 males, 3 females, 1 ovig. female, 1 hatchling (NSMT-Cr 24042), Hazama (backshore, pebbles and litter), Banda, 15 May 1998; Morino, H. collect.

TOKYO: 2 males (NSMT-Cr 24023); Hirayama (*Sasa, Camellia japonica, Dastanopsis caspidata sieboldii*), Miyake Island; 7 Dec. 1983; Nakamura, O. collect.

KANAGAWA: 1 male (NSMT-Cr 23996); Sarushima, Yokosuka; date and collector unknown. 1 male (NSMT-Cr 24039); Koajiro Bay (reed bed); Miura; 4 Jun. 2004; Wada, K. collect. 3 males, 1 juvenile (NSMT-Cr 24058); Sajima, Miura Peninsula; 2 Nov. 1975; Miyamoto, H. collect. 1 male, 6 females, 1 ovig. female (NSMT-Cr 24059); Enoshima, Fujisawa; 28 May 1997; Miyamoto, H. collect.

SHIZUOKA: 1 male (NSMT-Cr 24021); Nabeta Bay (backshore, litter), Shimoda; 18 May 1983; Morino, H. collect.

AICHI: 1 male, 1 juvenile (NSMT-Cr 24062); Takeshima, Gamagori; 19 Oct. 1975; Miyamoto, H. collect. 1 male, 1 juvenile (NSMT-Cr 24063);

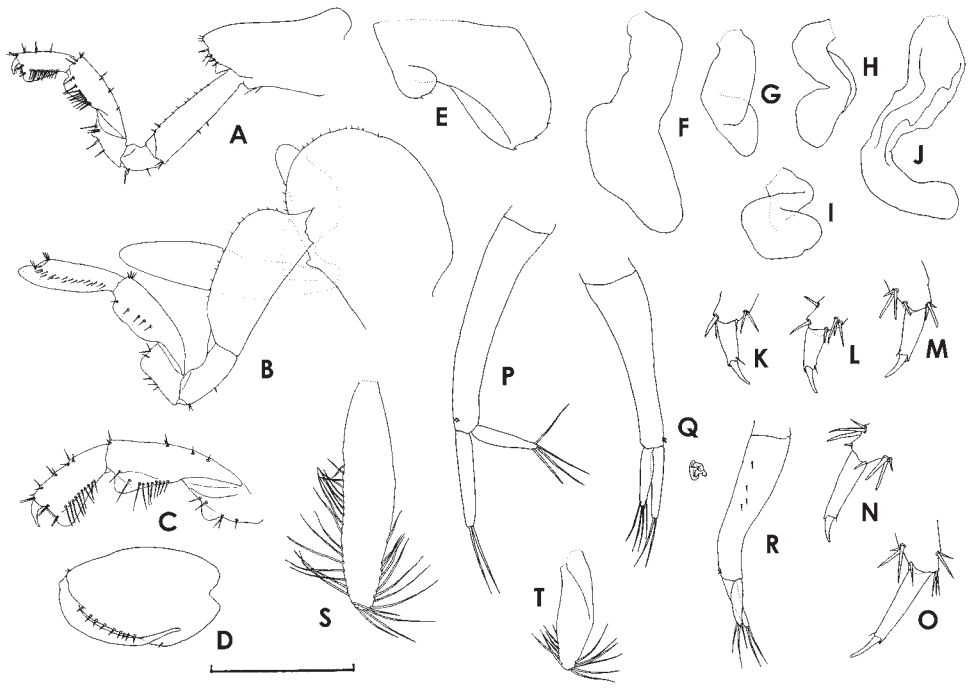

Fig. 5. *Pyatakovestia iwasai* gen. et sp. nov. A–B, female, 16.7 mm (allotype, NMST-Cr 24008); C–T, male, 17.4 mm (holotype, NMST-Cr 24007). Hiraiso, Ibaraki, Japan. — A, gnathopod 1; B, gnathopod 2; C, distal articles of gnathopod 1; D, propodus and dactylus of gnathopod 2; E, coxa of pereopod 6; F–J, coxal gills of pereopods 2–6; K–O, distal articles of pereopods 3–7; P–R, pleopods 2, 1, 3 and enlarged retinacula of pleopod 1; S, T, oostegites of pereopods 2 and 5. Scale: A–B, S–T, 1.85 mm; C, 1.42 mm; D, 2.50 mm; E, 0.63 mm; F–O, 0.94 mm; P–R, 0.71 mm.

Irago-misaki, Atumi Peninsula; 24 Nov. 1974; Miyamoto, H. collect.

WAKAWAMA: 1 unsexed (NSMT-Cr 23993); Hatakejima Island (supralittoral, stranded matter), Tanabe Bay; 15 Sept. 1972; Morino, H. collect. 1 female (NSMT-Cr 24005); Takurazaki (rocky shore, under stones), Wakayama; 15 May 1975; Nunomura, N. collect. 1 female (NSMT-Cr 24037); Yukashi Lagoon, Nachi-Katsu-ura; date unknown; Wada, K. collect.

FUKUI: 5 males, 7 females, 1 juvenile (NSMT-Cr 24024); Mera, Itozaki; 8 Dec. 1986; Miyamoto, H. collect. 2 males, 1 female (NSMT-Cr 24060); Mohara, Echizen-cho; 18 Nov. 1976; Miyamoto, H. collect. 8 males, 6 females, 2 juveniles (NSMT-Cr 24061); Takasu; 6 Dec. 1986; Miyamoto, H. collect.

SHIMANE: 1 female (NSMT-Cr 24015); Oku, Saigo-cho, Oki Islands; 18 Sept. 1975; Nunomura, N. collect. 2 females, 1 juvenile (NSMT-Cr 24038); estuary of Ohashi River (supralittoral), Matsue; 29 Jul. 2003; Toda, K. collect.

TOKUSHIMA: 1 male, 4 juveniles (incl. hatchling) (NSMT-Cr 23990); Ohama Beach (pebbles, stranded matter), Hiwasa; 2 Oct. 1971; Morino, H. collect.

NAGASAKI: 1 juvenile (NSMT-Cr 23992); Oshima Island, Danjo Islands, Fukue; 5–6, Aug. 1972; Minato, H. collect. 3 males, 12 juveniles (NSMT-Cr 24057); Azu (sea shore), Tsushima Island; 2 Aug. 1983; Miyamoto, H. collect.

MIYAZAKI: 2 males (NSMT-Cr 23988); Horikirizaki (under stranded matter on supralittoral rocky floor); 18 May 1971; Morino, H. collect. 1 female, 1 ovig. female, 7 juveniles (NSMT-Cr 24022); Ibii, Nichinan; 23 Sept. 1983; Nunomura, N. collect.

KAGOSHIMA: 3 males, 3 females, 3 ovig.

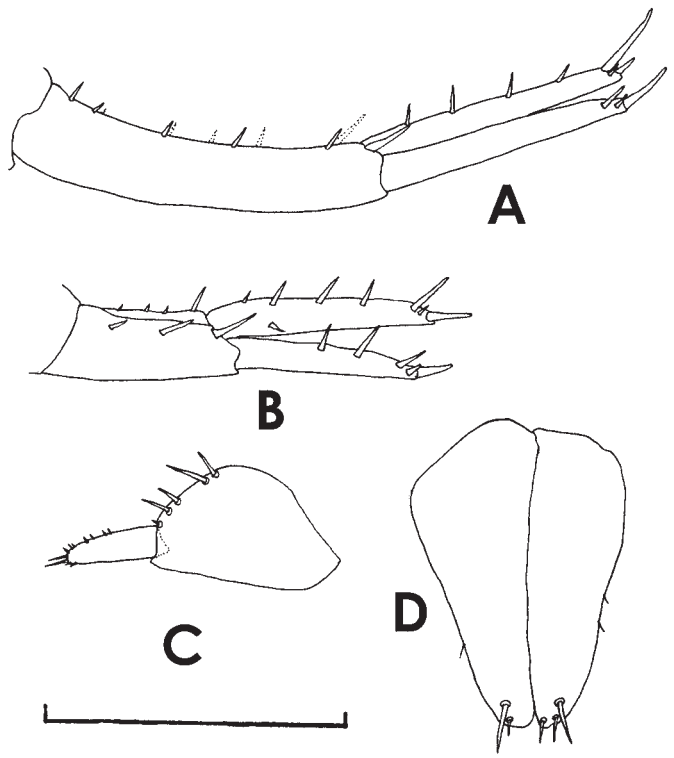

Fig. 6. *Pyatakovestia iwasai* gen. et sp. nov. Male, 17.4 mm (holotype, NMST-Cr 24007). Hiraiso, Ibaraki, Japan. — A–C, uropods 1–3; D, telson. Scale: A–B, 1.85 mm; C, 1.43 mm; D, 0.83 mm.

females, 3 juveniles (NSMT-Cr 24016); mid-point between Odomari and Tajiri (subtropical forest, "no. 10"; *Cycas revolute, Alocasia odora*), Satamisaki, Osumi; 7 Oct. 1982; Morino, H. collect. 1 male, 1 female, 1 juvenile (NSMT-Cr 24018); mid-point between Odomari and Tajiri (subtropical forest, "no. 14"), Satamisaki, Osumi; 7 Oct. 1982; Morino, H. collect. 1 juvenile (NSMT-Cr 24019); near Odomari (coastal grassland, "no. 7"), Satamisaki, Osumi, 7 Oct. 1982; Morino, H. collect. 1 male, 2 females, 1 ovig. female, 10 juveniles (incl. hatchlings) (NSMT-Cr 24020); near Odomari (coastal forest, "no. 30"), Satamisaki, Osumi; 7 Oct. 1983; Morino, H. collect. 1 male, 2 juveniles (NSMT-Cr 24017); 1 km south of Tajiri (coastal forest, "no. 17"), Satamisaki, Osumi; 7 Oct. 1983; Morino, H. collect. 1 male, 3 females, 2 juveniles (NSMT-Cr 24026); Satomura Shrine (forest), Nakanoshima Island, Tokara Islands; 9 Mar. 1994; Kurozumi, T. collect. 2 females (NSMT-Cr 23989); Seisui Beach (pebbles shore, stranded matter), near Koniya, Amami-oshima; 28 Jul. 1971; Morino, H. collect.

OKINAWA: 1 male, 2 females (NSMT-Cr 23994); Awase, Katsuren Bay; 25 Mar. 1975; Morino, H. collect. 1 male, 2 females, 1 ovig. female (NSMT-Cr 24014); near Yagazi Bridge (pebbles shore, litter), Yagazi Island; 22 May 1978; Morino, H. collect. 1 male (NSMT-Cr 24001); Sonai, Iriomote Island; 21 Jun. 1975; Nunomura, N. collect. 1 male, 3 females, 1 juvenile (NSMT-Cr 24002); Sumiyoshi (supralittoral, stranded matter); 21 Jun. 1975; Nunomura, N. collect. 1 male, 1 female, 1 juvenile (NSMT-Cr 24064); Yonaguni Island; 6 Aug. 1984; Miyamoto, H. collect.

Description of male (holotype). Antenna 1 (Fig. 4B), flagellum with 6 articles, article 4 longest. Antenna 2 (Fig. 4A), peduncular article 5 distinctly longer than 3 and 4 combined; flagel-

Fig. 7. Geographical distribution of *Pyatakovestia iwasai* gen. et sp. nov.

lum (right side) with 25 articles. Upper lip (Fig. 4J) lacking robust setae. Mandible (Fig. 4F–G), incisor 6-dentate, left lacinia clearly 5-dentate. Maxilliped, precoxa stepped (Fig. 4C), other parts of maxilliped, maxillae and lower lip (Fig. 4D–E, H–I, K) same as those of other talitrid species.

Gnathopod 1 (Figs. 4A, 5C), carpus *ca.* 1.5 times as long as propodus, with row of 10 setae on lateral surface, propodus with row of 10 setae on lateral surface, palmar margin vertical, exceeding dactylus. Gnathopod 2 (Figs. 4A, 5D), propodus palmar margin smooth, subequal to posterior margin in length, dactylus attenuate apically. Pereopods 3–7, propodi locking robust setae developed (Fig. 5K–O). Pereopod 4 subequal to pereopod 3 in length (Fig. 4A), dactylus (Fig 5L) not pinched. Ventral margins of coxae of pereopods 2–5 with several fine setae. Pereopods 6 and 7 distinctly longer than pereopod 5 (Fig. 4A). Coxal gills of pereopods 2 and 6 much longer than those of pereopods 3–5, the latter convoluted (Fig. 5F–J).

Pleonite side plates (Fig. 4A), posterodistal corner acuminated, with a few setules on posterior margins, lacking marginal pits. Pleopod 1 (Fig. 5Q) shorter than pleopod 2 (Fig. 5P) and longer than pleopod 3 (Fig. 5R). Peduncle of

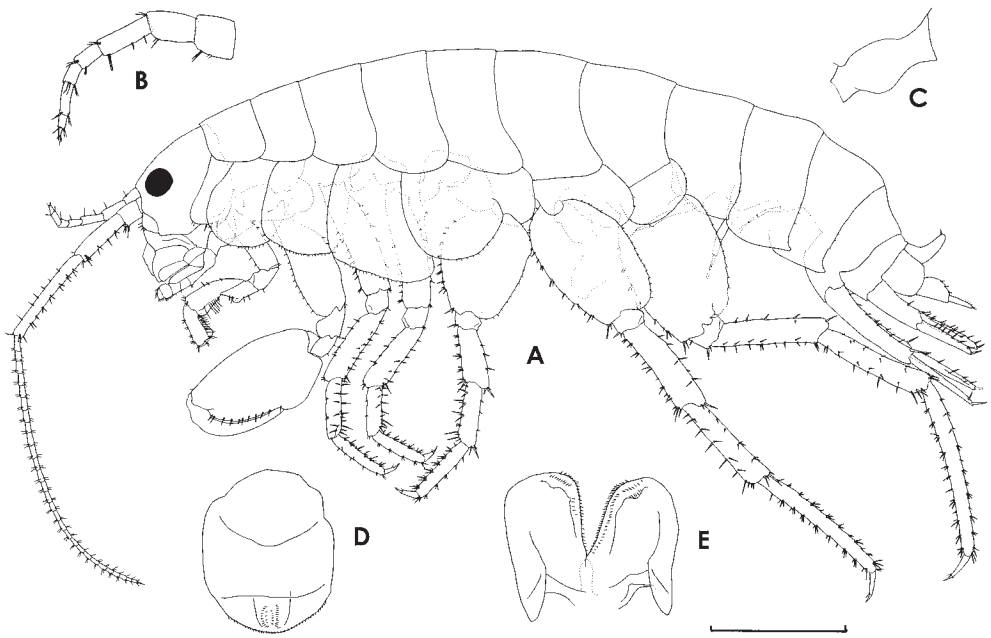

Fig. 8. *Pyatakovestia boninensis* gen. et sp. nov. Male, 14.1 mm (holotype, NSMT-Cr 23981). Mt. Sekimon, Hahajima Island, Ogasawara, Japan. — A, habitus, lateral view (after Morino, 2015); B, antenna 1; C, maxilliped precoxa; D, upper lip; E, lower lip. Scale: A, 2.50 mm; B–C, 1.26 mm; D–E. 0.56 mm.

pleopod 3 weakly robust-setose. Rami of pleopods 1–3 are 0.40, 0.44, 0.35 times as long as peduncles of respective peduncle.

Uropod 1 (Fig. 6A), inner ramus with 4 dorsomarginal robust setae, outer ramus marginally bare. Uropod 2 (Fig. 6B), rami subequal in length, inner ramus with 4 dorsomarginal and 1 outer marginal robust seta, outer ramus with 2 marginal robust setae. Uropod 3 (Fig. 6C), peduncle with 5 robust setae on dorsal margin, ramus with several short setae on dorsal and apical margin with a few longer setae apically. Telson (Fig. 6D), distinctly longer than wide, with 1–2 fine setae on lateral margin and 2–3 robust setae apically.

Female (allotype, sexual characters). Gnathopod 1 (Fig. 5A) not significantly different from male (holotype), with row of 10 and 12 setae on lateral surface of carpus and propodus, respectively. Gnathopod 2 (Fig. 5B) as generic diagnosis. Oostegites of pereopod 2 (Fig. 5S) and pereopod 5 (Fig. 5T) with 30 and 12 simple-tipped setae, respectively.

Etymology. The species name is dedicated to Prof. M. Iwasa, who initiated taxonomic studies of the Japanese talitrids in middle 1900's.

Distribution. The present species has been collected from the pebbles shore of supralittoral zones to backshores and coastal environments including grasslands and forests. Geographically it occurs in central and south-western Honshu, Shikoku, Kyushu and many islands in Nansei Archipelago (Fig. 7).

Remarks. *Pyatakovestia iwasai* sp. nov., *P. gageoensis* and the next species, *P. boninensis* sp. nov. compose a cluster in having the marginally bare outer ramus on uropod 1, in contrast to the robust-setose state in *P. pyatakovi*. This may be recognized as generic or sub-generic level of difference. However, the four species are so similar in the other characters and the fact that this genus exhibits variation in the armature of uropod 2 may suggest low level taxonomic value of uropod variation within this cluster. Thus we refrain from the division of this genus. The diagnosis of the species is given in the key.

The habitat of this species is similar to that of

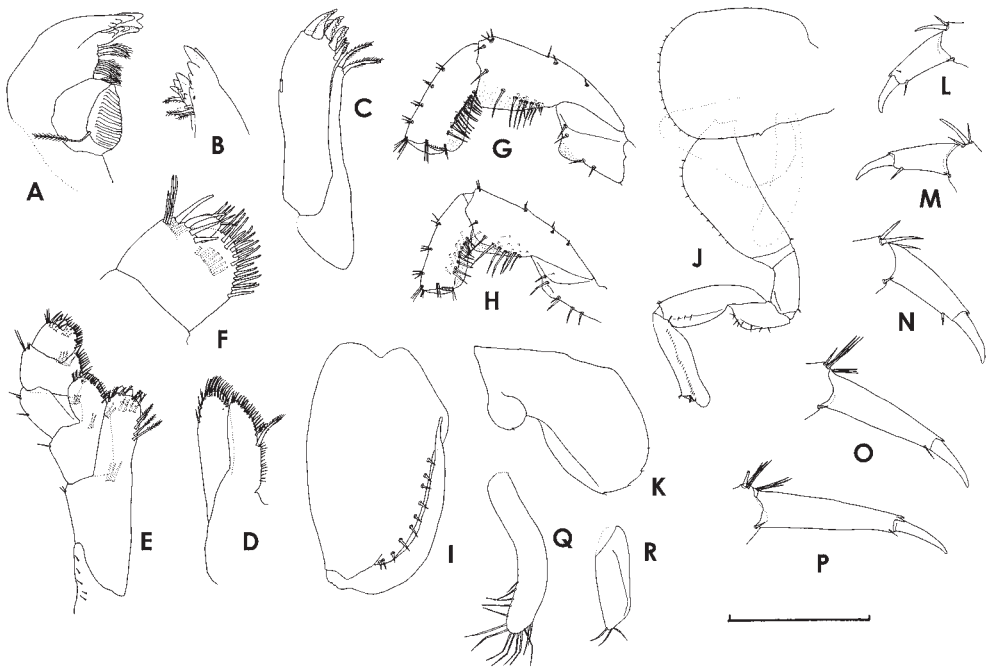

Fig. 9. *Pyatakovestia boninensis* gen. et sp. nov. A–G, I, K–P, male, 14.1 mm (holotype, NSMT-Cr 23981). Mt. Sekimon, Hahajima Island, Ogasawara, Japan. H, J, Q–R, female 15.2 mm (allotype, NSMT-Cr 23977). Okimura, Hahajima Island, Ogasawara, Japan. — A, left mandible; B, distal part of right mandible; C, maxilla 1; D, maxilla 2; E, maxilliped; F, palp articles 3 and 4 of maxilliped; G, distal articles of gnathopod 1; H, distal articles of gnathopod 1; I, propodus and dactylus of gnathopod 2; J, gnathopod 2; K, coxa of pereopod 6; L–P, distal articles of pereopods 3–7; Q–R, oostegites of pereopods 2 and 5. Scale: A–E, 0.56 mm; F, 0.21 mm; G–H, 0.94 mm; I, K, 1.43 mm; J, Q–R, 1.61 mm; L–P, 0.48 mm.

P. pyatakovi (and *P. gageoensis*), but is more eurytopic and encompasses the landward habitats: *P. iwasai* sp. nov. is frequently collected from the coastal grasslands and forests. Geographically it shows a complimentary pattern of distribution to *P. pyatakovi* (see Fig. 3), having northern limits in central Honshu (*vs.* southern limits in the central Honshu), dominating on Pacific coast (*vs.* on the Japan Sea coast). *Nipponorchestia curvatus* Morino and Miyamoto, 2015 also occurs in the coastal habitats, and its geographical distribution fairly overlaps with the present species (Morino and Miyamoto, 2015, fig. 5). However, *N. curvatus* is not collected so frequently as *P. iwasai* and both species have rarely been collected sympatrically.

It should be pointed out that the present species shows tendency to occur in the coastal habitats on peninsulas and smaller islands; Boso Peninsula in Chiba, Izu Peninsula in Shizuoka, Satamisaki Peninsula in Kagoshima provided relatively rich populations during this study. The present species seems to adapt to warm-coastal environments.

Pyatakovestia boninensis sp. nov.

[Japanese name: Ogasawara-hosohamatobimushi]
(Figs. 8–10)

Paciforchestia sp. 1: Morino, 2015, 1080 (fig. 1), 1087.

Type material. Holotype (NSMT-Cr 23981), male 14.1 mm; Mt. Sekimon (*Fagata ailanthoides* forest), Hahajima Island, Ogasawara Islands, TOKYO; 1 Nov. 1977; Sato, S. collect. Allotype (NSMT-Cr 23977), female 15.2 mm; Okimura, Hahajima Island, Ogasawara Islands, TOKYO; 28 Jul. 1973; Minato, H. collect. Paratypes: male 12.6 mm (NSMT-Cr 23979), female 14.2 mm

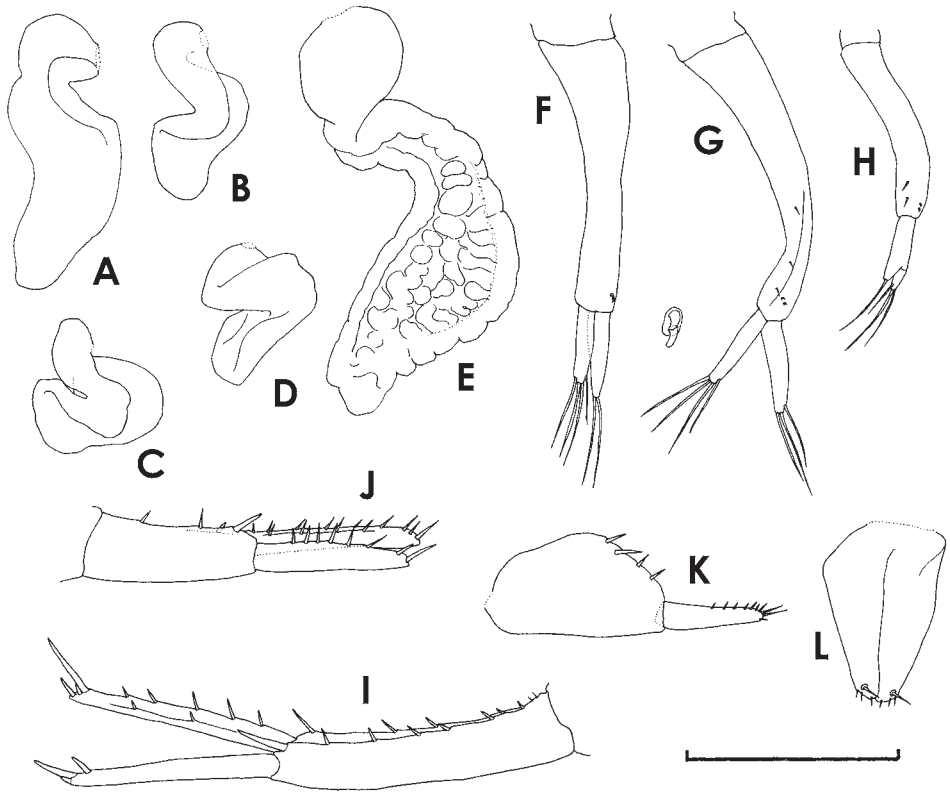

Fig. 10. *Pyatakovestia boninensis* gen. et sp. nov. Male, 14.1 mm (holotype, NSMT-Cr 23981). Mt. Sekimon, Hahajima Island, Ogasawara, Japan. — A–E, coxal gills of pereopods 2–6; F–H, pleopods 1–3 and enlarged retinacula of pleopod 1; I–K, uropods 1–3; L, telson. Scale: A–E, I–J, L, 1.43 mm; F–H, 0.63 mm; K, 0.94 mm.

(NSMT-Cr 23978); same data as the allotype.

Additional material examined. All materials are from Hahajima Island, Ogasawara Islands, TOKYO. 1 male, 1 female, 1 ovig. female (NSMT-Cr 23980); Okimura; 28 Jul. 1973; Minato, H. collect. 3 females, 9 juveniles (NSMT-Cr 23982); Mt. Sekimon (*Fagata ailanthoides* forest); 1 Nov. 1977; Sato, S. collect. 3 males, 4 females (NSMT-Cr 23983); Mt. Sekimon (*ca.* 350 m alt. under litter); 9 Aug. 1989; Morino, H. and Hikita, N. collect. 1 female (NSMT-Cr 23984); Mt. Kuwanoki (beside a mountain track, under litter); 9 Aug. 1989; Morino, H. and Hikita, N. collect. 1 male and 1 female (NSMT-Cr 23986); on the way from Sekimon to Mt. Sakaigatake; 3 Jul. 1997; Matsumoto and Kishimoto, T. collect. 2 females (NSMT-Cr 23987); Mt. Chibusa; Feb. 1997; Kishimoto, T. collect.

Description of male (holotype). Antenna 1 (Fig. 8B), flagellum with 5 articles, article 3 longest. Antenna 2 (Fig. 8A), flagellum with 29 articles. Gnathopod 1 (Fig. 9G), carpus *ca.* 1.4 times as long as propodus, with row of 6 setae on lateral surface, propodus with 13 setae on lateral surface. Gnathopod 2 (Fig. 9I), propodus palmar margin *ca.* 2 times as long as posterior margin. Pereopods 3–7, propodus locking robust setae weakly developed (Fig. 9L–P). Coxal gill of pereopod 6 (Fig. 10E), surface slightly balbous.

Pleopods 1–3 (Fig. 10F–H), rami 0.31, 0.33, and 0.44 times as long as respective peduncle. Rami of pleopod 3 fused basally. Uropod 1 (Fig. 10I), inner ramus with 5 dorsomarginal and 2 outer marginal robust setae, outer ramus marginally bare. Uropod 2 (Fig. 10J), inner ramus with

Fig. 11. Distribution of *Pyatakovestia boninensis* gen. et sp. nov.

6 dorsomarginal and 4 outer marginal robust setae, outer ramus with 6 marginal robust setae.

Female (allotype, sexual characters). Gnathopod 1 (Fig. 9H), carpus and propodus with row of 7 and 10 setae on lateral surface. Oostegites slender, with 13 and 3 simple-tipped setae on those of pereopods 2 and 5 (Fig. 9Q, R), respectively.

Etymology. The species name refers to the Ogasawara Islands in English, where Hahajima Island, the type locality, belongs to.

Distribution. So far this species has been collected from mountain forests in Hahajima Island, Ogasawara Islands (Fig. 11).

Remarks. This species exhibits a peculiar feature in the heavier armature of uropod 2 rami. The number of robust setae on the rami varies among type specimens as follows: inner ramus with 4–6 dorsomarginal and 3–5 outer marginal setae, outer ramus with 5–6 marginal setae. Armature of inner ramus of uropod 1 also shows variation: the allotype and a paratype lack outer marginal setae and the other paratype bears one seta. The rami of pleopod 3 in the allotype and paratypes are not fused in the basal part. The diagnosis of this species is given in the key. The elongate propodus of male gnathopod 2 and the slender and less setose oostegite of pereopod 2

also distinguish *P. boninesis* from the other congeners. The present species displays adaptation to the most inland habitat among the four congeners, so far collected from mountain forests and not from supralittoral or coastal habitats.

Morphologically this species is as close to *P. iwasai* as to *P. gageoensis.* The former two species share the non-inflated and smooth dactyli on pereopods 3–5, whereas the latter two have the less setose armature on uropod 2 in common. The geographical distribution suggests that *P. boninensis* originated from isolated populations of ancestral *P. iwasai* at the southern-most peripheral area.

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