

A new genus and a new species of alpheid shrimp (Decapoda, Caridea) from Japan

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ABSTRACT

A new genus of the family Alpheidae is established, based on a new species from Japanese waters. *Cavipelta yamashitai* n.g., n.sp. is characterized by having a sinus on the lower margin of the carapace in both sexes and a flap-like process on the exopod of the uropod in large males. It also bears a robust and thickened antennal flagellum and a mesially curved chela of the first pereopod in large males. *C. yamashitai* was usually collected from burrowes of thalassinids. The systematic position of the new genus is discussed and the biology of the new species is briefly presented.

KEY WORDS

Crustacea,
Decapoda,
Alpheidae,
Cavipelta,
new genus,
new species,
Pacific Ocean.

RÉSUMÉ

Un nouveau genre et une nouvelle espèce de crevette alpheïde (Decapoda, Caridea) provenant du Japon. *Cavipelta yamashitai* n.g., n.sp. est caractérisée par la présence d'un sinus sur le bord inférieur de la carapace dans les deux sexes et d'un appendice foliacé sur l'exopodite de l'uropode chez les grands mâles. Elle porte également un flagelle antennaire robuste et épaissi et la pince du premier péréopode est courbée en son milieu chez les grands mâles. *C. yamashitai* est généralement récoltée dans les terriers de thalassinides. La position systématique de ce nouveau genre est discutée ainsi que la biologie de cette nouvelle espèce.

MOTS CLÉS

Crustacea,
Decapoda,
Alpheidae,
Cavipelta,
nouveau genre,
nouvelle espèce,
océan Pacifique.

INTRODUCTION

During studies on the shrimp fauna of the Seto Inland Sea, Japan, Yamashita (1980) collected a small alpheid from burrow of *Upogebia major* (De Haan). He tentatively identified it with *Athanas* sp. and briefly presented its ecological notes. Fortunately I could examine a part of his material, and later I received other specimens of the same species collected from the tidal flat of several localities of southern Japan. As roughly illustrated in Yamashita (1980), this species is readily distinguished from all the known species of *Athanas* by having a rounded sinus at the middle of the lower margin of carapace and rounded pectinations on the diaeresis of the outer uropod. These features are possibly unique in the family Alpheidae and even in the section Caridea, and for this reason the new genus, *Cavipelta*, is defined for the species, *C. yamashitai* n.sp.

All specimens have been deposited in the collection of the National Fisheries University (NFU). The specimen size is indicated by the carapace length (CL) including the rostrum.

Family ALPHEIDAE Rafinesque, 1815

Cavipelta n.g.

TYPE SPECIES. — *Cavipelta yamashitai* n.sp.

ETYMOLOGY. — The name is derived from the Latin *cavus*, meaning hollow, and *pelta* meaning shield, in reference to the fact that the lower margin of the carapace is apparently hollowed in the species of this genus. The gender is feminine.

DIAGNOSIS

Small alpheid, about 25 mm in body length. Rostrum short, acute; carapace smooth, without carina or spine but with rounded insertion at middle of lower margin; cardiac notch well-developed. Abdomen smooth without carinae or spines. Triangular flap articulated at posterolateral angle of sixth somite. Telson with two pairs of dorsal spines; posterior margin not terminating in triangular tooth, with two pairs of spines laterally. Anal tubercle absent.

Eyes largely exposed from dorsal view. Antennular peduncle long; stylocerite triangular,

well developed. Antennal peduncle robust, with scaphocerite reduced; flagellum robust and long. Mandible with molar process and 2-jointed palp articulated with base of incisor process. Palp of first maxilliped 2-segmented. Second maxilliped without podobranch. Third maxilliped with arthrobranch; coxa with both strap-like epipod and flattened process. Exopods on first to third maxilliped well-developed. First pereopods moderately robust, similar and equal, carried extended; fingers lacking molar tooth and fossa. Second pereopod slender with 5-segmented carpus. First three pereopods with strap-like epipod. Uropod with long and articulated flap on distal end of exopod in large males but without in females; diaeresis of exopod with series of rounded lobes in both sexes. Appendix masculina longer than appendix interna but not overreaching endopod of second pleopod.

Gill formula as follows:

	Maxilliped			Pereopod				
	1	2	3	1	2	3	4	5
Pleurobranch	-	-	-	1	1	1	1	1
Arthrobranch	-	-	1	-	-	-	-	-
Podobranch	-	-	-	-	-	-	-	-
Mastigobranch	-	-	-	1	1	1	1	-
Epipod	1	1	1	1	1	1	-	-
Exopod	1	1	1	-	-	-	-	-

SYSTEMATIC POSITION

Cavipelta probably belongs to the primitive group of the family Alpheidae, characterized by having a short rostrum, dorsally exposed eyes, articulated plate of sixth abdominal somite, no sound-producing mechanism on the first pereopods, serrated diaeresis of the exopod of uropod and pereopodal epipods. *Potamalpheops* Powell, 1979 and *Pseudoathanas* Bruce, 1983 share these characters with the new genus. However, *Cavipelta* is unique among the family in bearing a sinus on the lower margin of the carapace in both sexes, and having flap-like processes on the exopod of the uropod in adult males. These features are apparently uncommon in the family, and even in the Caridea, although some similar features are observed in a few groups.

The anterolateral angle of the carapace is fairly excavated in some genera of the family Pasiphaeidae (Holthuis 1993). In *Cavipelta* the central part of the lower margin of the carapace, at about the level of the base of the first or second pereopods, is sinuous. This sinus is developed in large specimens of both sexes, and less in small specimens.

Some specified features of the uropods are observed in other alpheids. The serrated diaeresis appears in some alpheids; many movable spines in *Pseudoathanas* (Bruce 1983) and some immovable spines in *Potamalpheops* (Powell 1979) and *Prionalpheus* (Banner & Banner 1960). There are some species of other alpheid genera with one or two spines or spiniform processes on the diaeresis (Crosnier & Forest 1966; Miya 1972; Hayashi 1996). However, in these genera the spines are more or less pointed, whereas in serrated lobes of *Cavipelta* they are immovable and large with rounded apex.

The extended uropodal exopod is not known in other alpheids. *Mohocaris bayeri* Holthuis, 1973 bears an extremely long and slender process on the uropod, but it is on the endopod (Holthuis 1973). *Racilius compressus* Paulson, 1875 has a large spine other than the outer distal one on the exopod of the uropod, but it is also on the endopod (Paulson 1875; Bruce 1985; Hayashi 1995). In contrast *Cavipelta* has a slender and elongated flap on the outer uropod. This flap is articulated with more than two segments. This character is seen in the large males only, and is entirely absent in small males as well as in ovigerous females in which the outer margin of the exopod is largely rounded as in other members of the family.

The uropodal serration is the best character to distinguish *Cavipelta* from the related genera, even in small individuals or female specimens which do not have a differentiated uropodal flap and the carapacial sinus.

Cavipelta also bears other features uncommon in other alpheids, such as a robust and thickened antennal flagellum, and a mesially curved chela of the first pereopod in large males. The antennal flagellum, which is larger in males than in females, is rigid, strengthened proximally and curved upward. The first pereopods are similar and usually set in the extended position. The

chela is sexually dissimilar. In large males it is curved mesially; the immovable finger is curved at a right angle or more than 90° to the palm. The movable finger, therefore, is situated perpendicularly at the distal end of the major part of the leg. In females and small males the chela is not modified, the finger is situated at a distolateral position.

The gill formula of *Cavipelta* is different from that of the related genera, *Pseudoathanas* and *Potamalpheops*. An arthrobranch is present on the base of the third maxilliped in *Cavipelta* and *Potamalpheops* (Powell 1979), but absent in *Pseudoathanas* (Bruce 1983). A strap-like epipod is present on the third maxilliped and the first four pereopods in *Potamalpheops* (Powell 1979), but on the first three pereopods only in *Pseudoathanas*. In the latter genus, there is no strap-like epipod on the third maxilliped, only a flattened process (Bruce 1983). In *Cavipelta* the strap-like epipod is present on first three pereopods and on the third maxilliped, and a flattened and anteriorly pointed process is also present.

Cavipelta yamashitai n.sp. (Figs 1-4)

Athanas sp. — Yamashita, 1980: 6, unnumbered fig.

MATERIAL EXAMINED. — **Seto Inland Sea.** Tidal flat, off Miyajima, Hiroshima Prefecture, living in tube of *Upogebia* major, 4.VIII.1980, Coll. K. Yamashita: 1 ♂, holotype (NFU No. 530-2-1877). — 13.II.1990, Coll. K. Yamashita: 10 ♂♂, 3 ovig. ♂, 3 ♀♀, paratypes (NFU No. 530-2-1878). — Tidal flat, off Kutanabe Shrine, Hirao, Yamaguchi Prefecture, Coll. M. Kamiichi: 1 ♂, paratype (NFU No. 530-2-1879). — Tidal flat, Toyo Port, Ehime Prefecture, 12.V.1995, Coll. Y. Ide: 1 ♂, 1 ♀, 2 juveniles, paratypes (NFU No. 530-2-1880).

Southern Sea of Japan. Mouth of Matsumoto River, off Hagi, Yamaguchi Prefecture, dredge sample, VIII.1984, Coll. M. Amio: 1 ovig. ♀, 1 juv., paratypes (NFU No. 530-2-1881).

ETYMOLOGY. — The specific name is dedicated to Mr. Kinji Yamashita, of the Miyajima Aquarium, who collected this species and called attention to it more than fifteen years ago.

SIZE. — The holotype, a complete male 6.8 mm CL. The males with a flap-like process on the exopod of

the uropod are more than 6.0 mm CL, and the largest male is 7.6 mm CL. The ovigerous females are nearly equal to males in size, 4.6-7.2 mm CL. A female of 6.8 mm CL bears about 100 eggs and their diameter is 0.5-0.6 \times 0.42-0.47 mm. The egg number and egg size of the other three females are similar to those of this female.

DESCRIPTION

Small alpheid with slender and smooth body (Fig. 1). Rostrum short triangular in dorsal view, reaching only to base of eye, with short mid-dorsal crest in larger specimens (Fig. 2A, B).

Carapace smooth, without spines on anterior margin (Fig. 2C); cardiac notch deep; lower margin with well-developed sinus at position of base of first or second pereopod (Figs 2B, 4B, C).

Abdomen smooth without carinae or spines. First pleuron sometimes with small indentation just above anterolateral corner (Fig. 4C). Pleura of fifth somite pointed but not sharp. Posterior process of sixth somite with small spine on upper distal end; articulated plate large and triangular (Figs 2D, 4H-J). Telson with two pairs of large spines, anterior pair at proximal fourth and posterior pair at middle (Figs 2D, 4H-J); posterior margin largely rounded with two pairs of spines laterally short outer and long inner.

Eyes exposed dorsally and laterally, with small anteromesial process (Fig. 2A-C); cornea well-pigmented, oval in outline in dorsal view (Fig. 2L). Antennule long and slender; stylocerite triangular, acute, reaching end of proximal one third of first segment; second segment 1.5 times as long as first; third segment much shorter than first (Fig. 2A, B, L); outer flagellum as long as peduncle, and thickened at several basal joints; inner flagellum slightly longer than peduncle with short setae on proximal half (Fig. 2L). Antennal peduncle more robust in males than in females, overreaching scaphocerite and antennular peduncle; scaphocerite comparatively small,

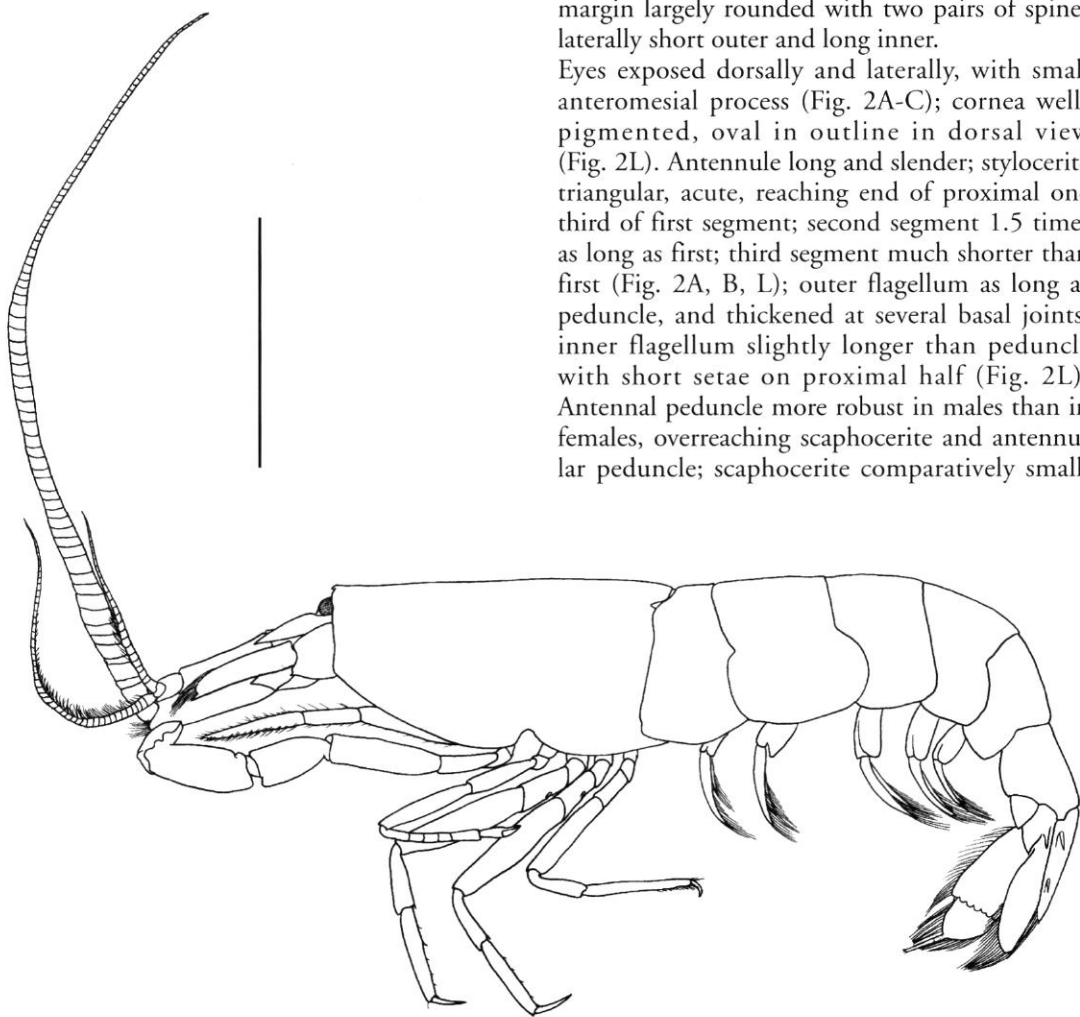


FIG. 1. — *Cavipelta yamashitai* n.sp., holotype, ♂ from Miyajima Island, 7.3 mm CL (NFU No. 530-2-1877). Scale bar: 5.0 mm.

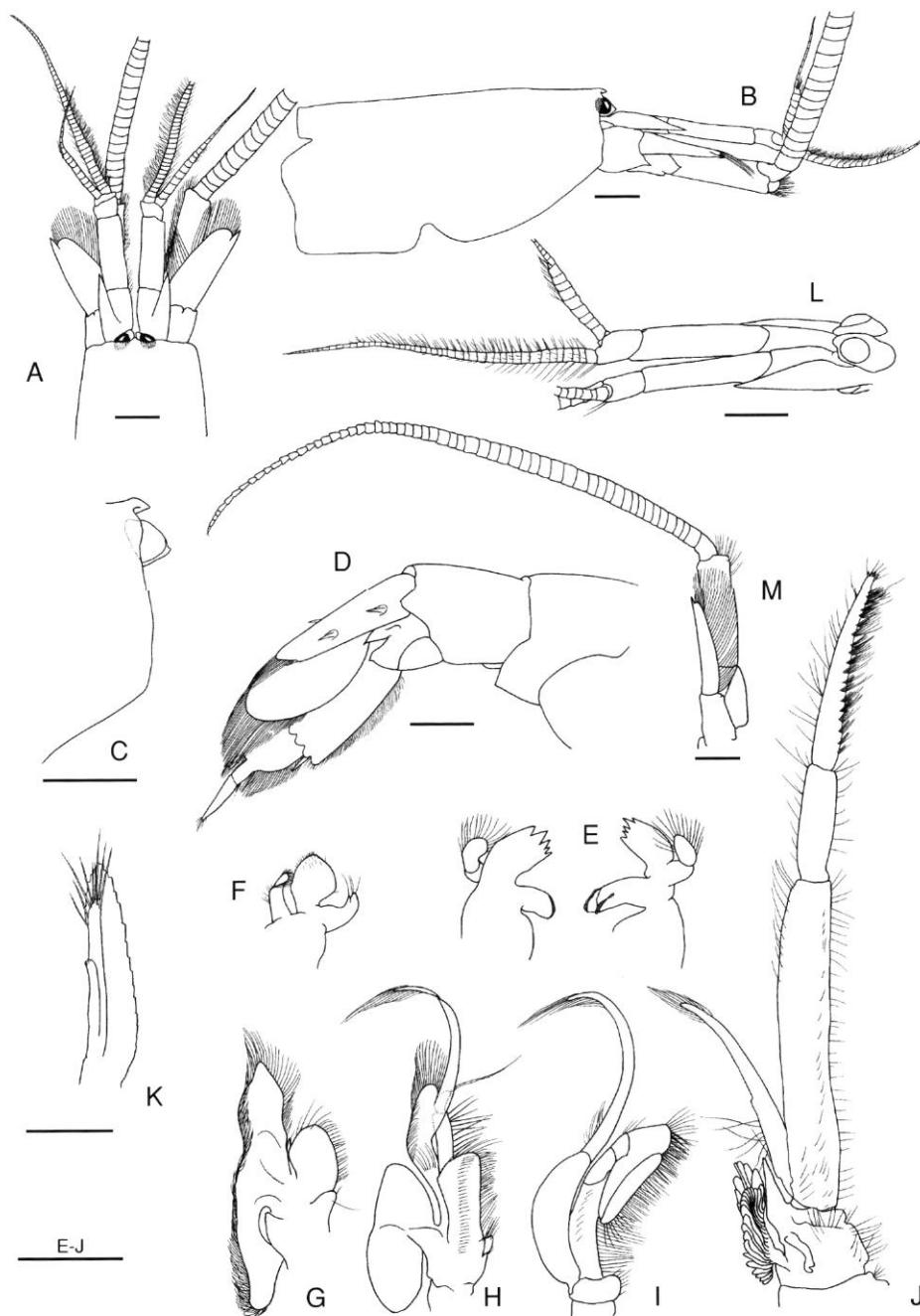


FIG. 2. — *Cavipelta yamashitai* n.sp., A-K, holotype, ♂ from Miyajima Island, 7.3 mm CL (NFU No. 530-2-1877); L-M, paratype, ♂ from Miyajima Island, 6.4 mm CL (NFU No. 530-2-1878, part); A, anterior part of body, dorsal view; B, same, lateral view; C, anterior part of carapace and eye, lateral view; D, posterior part of abdomen, lateral view; E, right mandible, outer (left) and inner (right) view; F, right maxillula; G, right maxilla; H, right first maxilliped; I, right second maxilliped; J, right third maxilliped; K, appendix interna and appendix masculina; L, thoracic appendages, oblique view; M, right antenna, ventral view. Scales bars: A-J, L, M, 1.0 mm; K, 0.5 mm.

with outer margin straight, ending in distinct spine overreaching lamella; flagellum rigid, and strengthened, more than twice as long as carapace (Figs 1, 2A, M).

Mouthparts not specific. Mandible composed of medium-sized molar process, broad incisor process with several teeth distally and 2-segmented palp attached to base of incisor process (Fig. 2E). Maxilla with broad distal endite and small proximal endite (Fig. 2G). First maxilliped with 2-segmented endopod, proximal segment small with stiff hair distally; epipod large, oval (Fig. 2H). Second maxilliped with long exopod and oblong epipod (Fig. 2I). Third maxilliped reaching distal end of antennal peduncle, with arthrobranch, strap-like epipod and long exopod; large flattened process present on coxa; proximal segment as long as distal two segments combined; distal segment less than twice as long as intermediate segment, with many rows of brush-like setae on lower margin and five short apical spines (Fig. 2J). First pereopod massive, equal, usually extended forward. In males overreaching end of antennal peduncle by chela; ischium less than half as long as merus, pointed at dorsodistal end; merus cylindrical, 1.8 times as long as ischium, with row of small spine-like processes on dorsal margin; carpus 1.2 times as long as ischium with one or two similar processes on dorsal margin. Chela as long as merus, palm cylindrical with small excavation near proximal articulation and few low processes just anterior of excavation; fingers curved mesially at right angle to palm in most specimens, or slightly backward in larger males; articulation of fingers present near outer distal part of palm and movable finger situated horizontally at anterior-most position; immovable finger with two large irregular teeth on cutting edge and movable finger with usually small tooth on cutting edge (Figs 3A, B, 4F). In ovigerous females first pereopod not specific; movable finger articulated normally with outer distal side of palm; fingers comparatively small, less than half as long as palm; dorsodistal end of ischium pointed; dorsal margin of merus serrated, but carpus smooth. In females and small males first pereopod similar to ovigerous females in general shape but merus and ischium with smooth margins (Fig. 4G). Second pereopod reaching end of antennal scale,

equal, slender; merus as long as ischium; carpus longer than merus, 5-segmented, proximal and distal segments subequal and longer than intermediate three segments; chela slightly shorter than distal two segments of carpus (Fig. 3C). Third pereopod overreaching antennal peduncle by dactylus; ischium with small spine on outer surface; merus about twice as long as ischium, unarmed; carpus as long as ischium with small spine on lower distal corner; propodus about 1.5 times as long as carpus, with three or four spines on posterior margin and one pair of spines on distal end; dactylus simple, acute, one half as long as propodus (Fig. 3D). Fourth pereopod reaching distal end of antennal; shape and spination similar to third pereopod (Fig. 3E). Fifth pereopod slenderer, reaching distal end of stylocerite; ischium and carpus unarmed; propodus with several rows of setae on distal half and one or two spines on proximal third or middle of posterior margin (Fig. 3F).

First pleopod bilobed, not specific in either sex. Endopod of second to fifth pleopods with slender appendix interna in both sexes. Male second pleopod with slender appendix masculina nearly twice as long as appendix masculina, but falling short of distal end of endopod; several long setae present near apex of masculina (Fig. 2K). Uropod broad, longer than telson; protopod ending in two pointed processes; endopod broad, oval, not specific (Figs 2D, 4H-J). Diaeresis of exopod with nine to fourteen, usually nine to eleven, rounded immovable lobes, outer two or three lobes subequal in size and larger than inner; outer margin of exopod ending in spinule situated at outer margin of outermost spine of diaeresis; distinct acute spine present under outermost or second spine of diaeresis (Figs 2D, 4H-J). Distal end of exopod with long flap in large males; in some specimens more than half of exopod, and composed of two or three segments (Figs 2D, 4H, I, K).

BIOLOGY

According to Yamashita (1980), the present species was found associated with the thalassinid *Upogebia major* (De Haan), on the tidal flat of Miyajima Island. He found that this shrimp swam out from the *Upogebia* burrow in which he

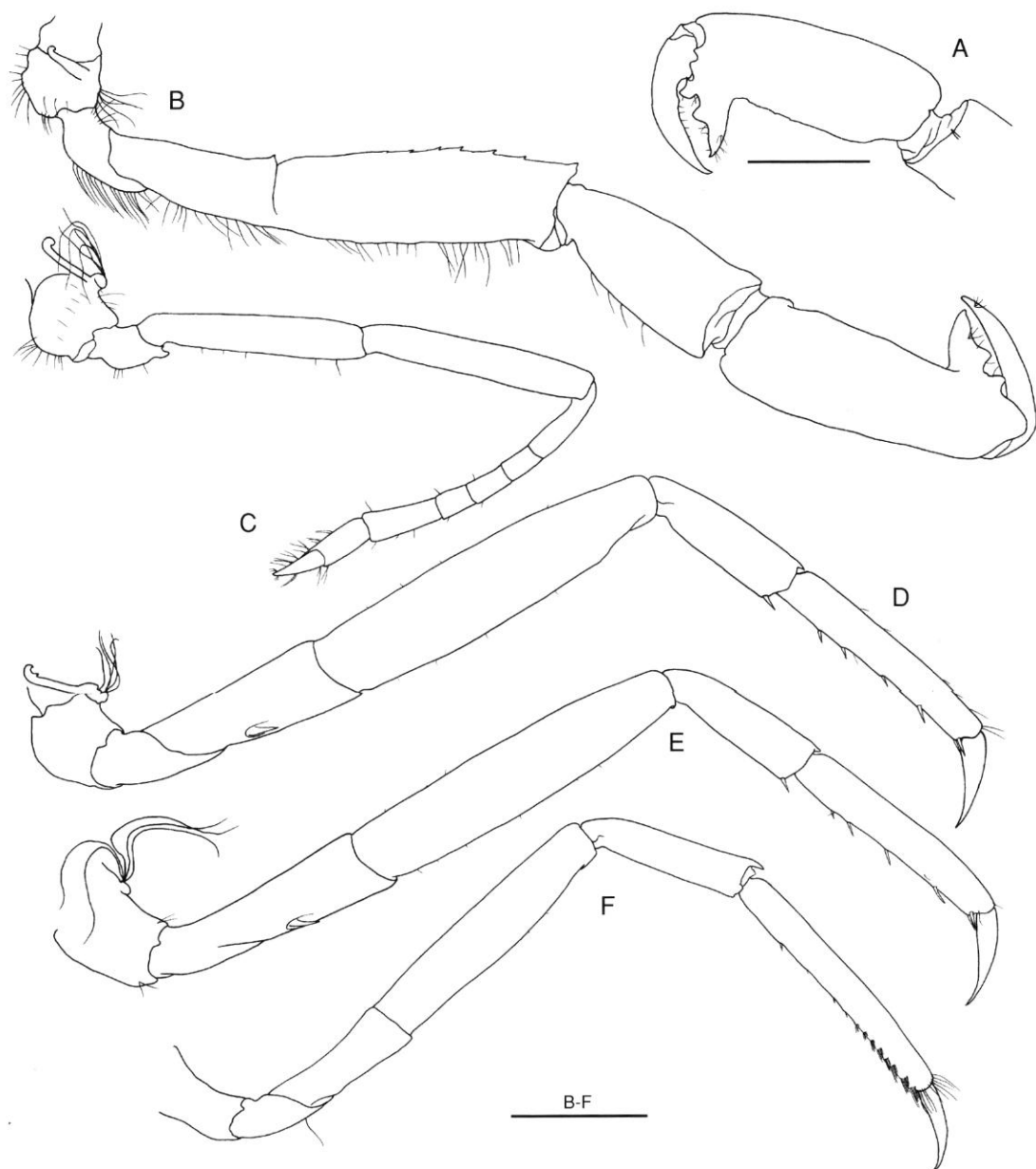


FIG. 3. — *Cavipelta yamashitai* n.sp., holotype, ♂ from Miyajima Island, 7.3 mm in CL (NFU No. 530-2-1877). A, chela of left first pereopod, mesial view; B, right first pereopod, outer view; C, right second pereopod, outer view; D, right third pereopod, outer view; E, right fourth pereopod, outer view; F, right fifth pereopod, outer view. Scale bars: 1.0 mm.

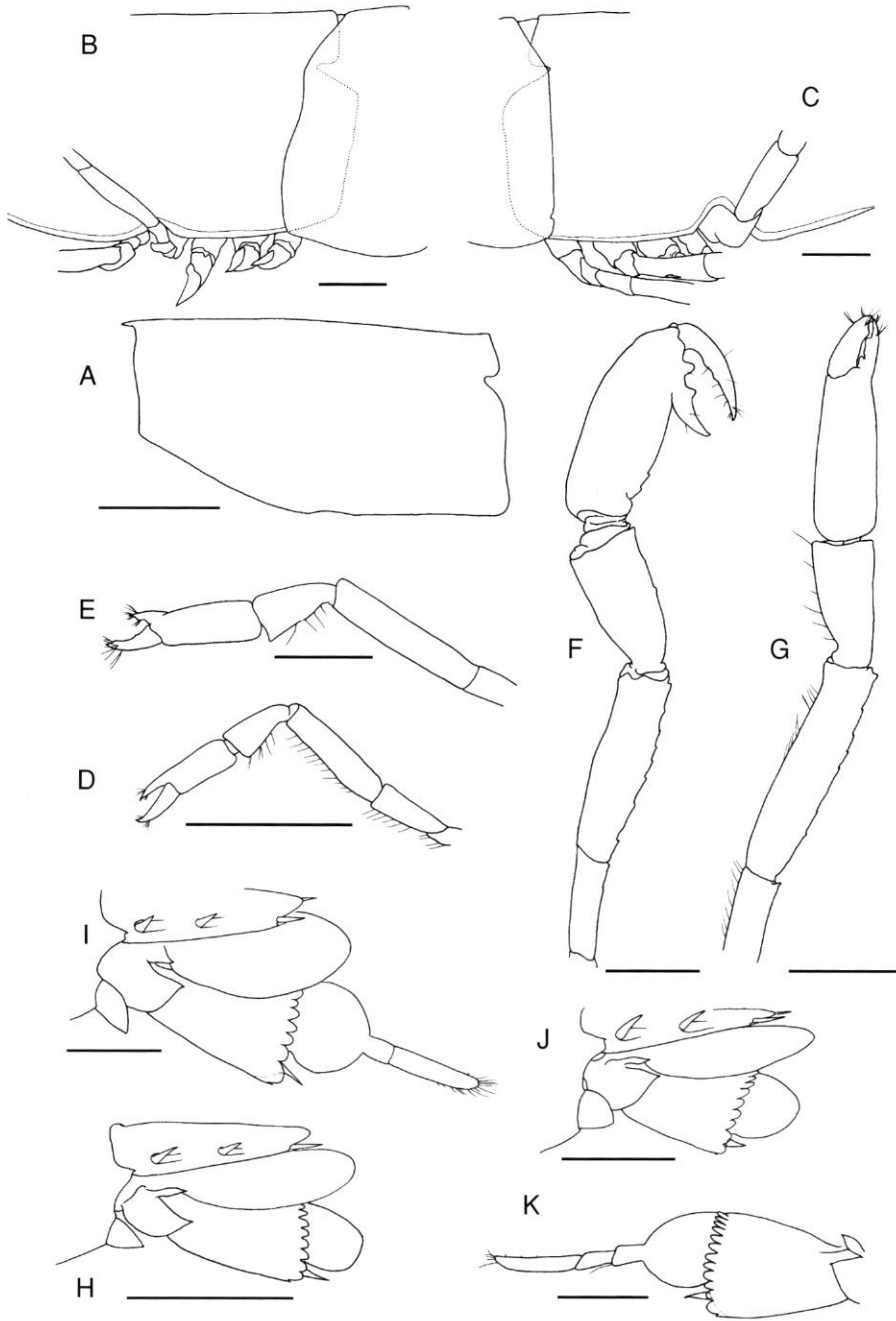


FIG. 4. — *Cavipelta yamashitai* n.sp. paratypes, A, E, ♀ from Toyo Port, 5.2 mm in CL (NFU No. 530-2-1880, part); B, G, ovigerous ♀ from Miyajima Island, 6.7 mm in CL (NFU No. 530-2-1878, part); C, ♂ from Miyajima Island, 6.9 mm in CL (NFU No. 530-2-1878, part); D, H, ♂ from Toyo Port, 3.1 mm in CL (NFU No. 530-2-1880, part); F, K, ♂ from Toyo Port, 6.3 mm in CL (NFU No. 530-2-1880, part); I, ♂ from Miyajima Island, 7.0 mm in CL (NFU No. 530-2-1878, part); J, ovigerous ♀ from Miyajima Island, 5.0 mm in CL. A, carapace, lateral view; B, C, posterior part of carapace, lateral view; D-G, left first pereopod, lateral view; H-J, tail-fan, oblique view; K, exopod of left uropod, oblique view. Scale bars: 1.0 mm.

poured a plaster to examine the shape of the burrow. Many specimens of this species were collected from the *Upogebia* burrow using this same method. The other material from Toyo Port indicates the possibility of the association with other than thalassinid shrimps, because the label indicates that it was collected together with *Callianassa japonica* Ortmann, *Upogebia major* and the bivalve *Macra veneriformis* Reeve. All other specimens of this species were collected from tidal flats of the southwestern part of Japan.

REMARKS

As mentioned above, Yamashita (1980) briefly described and illustrated this species under the name of *Athanas* sp. Part of his specimens are included in the present material examined.

Some important characters show considerable variation with sex and growth. The sinus on the lower margin of carapace is less developed or entirely absent in specimens less than 5.0 mm (Fig. 4A-C). The larger specimens always bear this sinus, and it is larger and deeper in males than in females. Judging from its position and shape it may be related to the smooth movement of the first (or second) pereopod.

The first pereopod of the large males morphologically differs from that of the females and the smaller males, especially the chela (Figs 1, 2B, 4D-G). The ovigerous females and small specimens have a normal slender chela, although with rough margins on the ischium and merus in ovigerous females. In large males the chela is curved mesially, and in the male from Toyo Port, the immovable finger is bent backward with two large teeth on the cutting edge. The palm, carpus, merus and ischium are provided with small spine-like processes on the mesial margin.

A long flap-like process extends from the outer margin of the exopod of uropod in large males only. It is entirely absent from ovigerous females and small specimens (Figs 2D, 4H-K). The long flap is composed of two or three joints. The function of this appendix could not be determined.

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