

## Three New Species of *Porcellidium* (Crustacea, Copepoda, Harpacticoida) from Iwate Prefecture, Japan

By

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**Abstract** Three new species belonging to the genus *Porcellidium* CLAUS (Porcellidiidae), *P. ofunatense*, *P. kiiroum* and *P. akashimum*, are described. Animals were collected from various seaweeds at Kadonohama Bay, Ofunato, Iwate Prefecture, Japan. Their relationship to other members of the genus is discussed.

### Introduction

Harpacticoid copepods belonging to the family Porcellidiidae living in coastal waters of Japan have been reported by various authors, but they have received little attention from taxonomists. GAMÔ (1969) was the first to show that the family was represented in Japan by giving a full and accurate description of a female specimen collected from Tanabe Bay (Wakayama Prefecture). He referred the animal to the genus *Porcellidium*, but did not name the species. ITÔ (1970) reported an unidentified species of *Porcellidium* living on *Ulva* which is abundant at Oshoro Bay, Hokkaido. GAMÔ and SUZUKI (1980) list four unidentified species of different colour pattern from Sagami Bay, Kanagawa Prefecture, which they referred to *Porcellidium*. MIZUNO and GAMÔ (1991) described and illustrated adults, nauplii and copepodite stages of another unidentified species referred to as *Porcellidium* sp. also from Sagami Bay. It is clear from these accounts that more than one species is involved, and some may belong to different genera.

Extensive sampling of seaweeds from a single locality on the NE coast of Honshu, Japan, by N. IWASAKI in 1993 yielded large numbers of harpacticoid copepods belonging to the family Porcellidiidae. Study of this material has revealed seven undescribed species belonging to this family. The present paper

describes three new species belonging to the genus *Porcellidium*.

### Materials and Methods

All specimens were collected from seaweeds in the sub-littoral at 5 stations in Kadonohama Bay, Ofunato, Iwate Prefecture, Japan (Fig. 1). Characteristics of

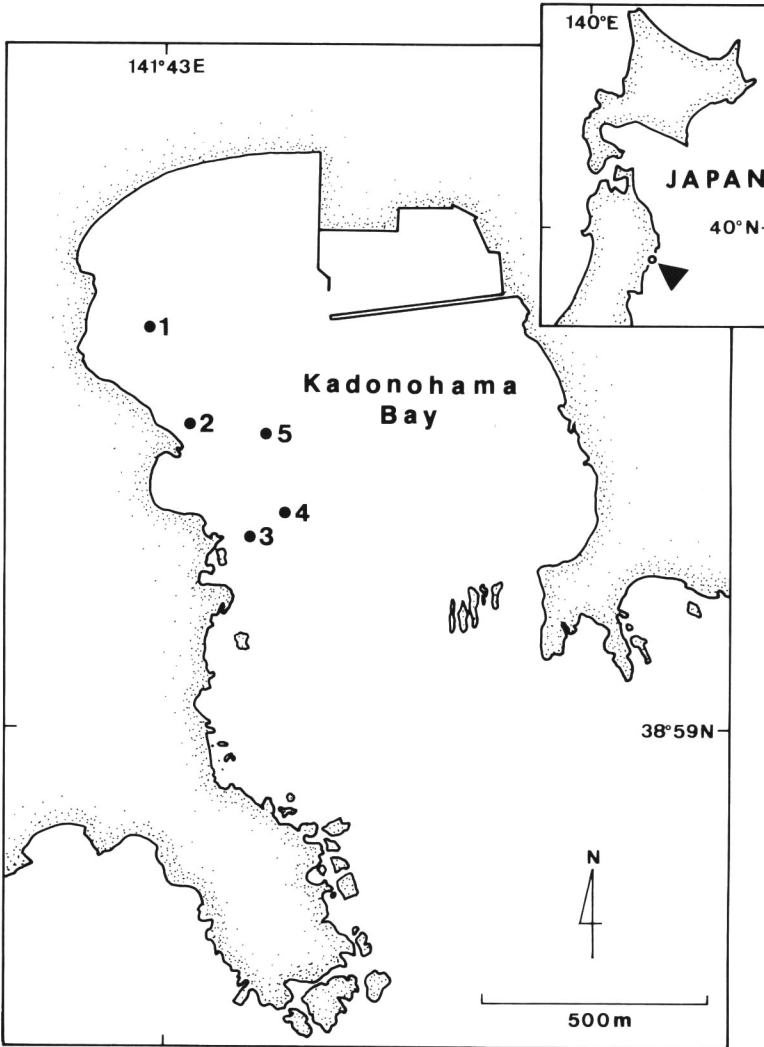


Fig. 1. Map of Kadonohama Bay, Iwate Prefecture, Japan, showing location of sampling stations. Stations 1–3, rock substratum with seaweed. Stations 4 & 5, rafts for aquaculture.

Kadonohama Bay are as follows. Maximum depth: about 20 m. Salinity: average 33.8 (May 1994–June 1995); maximum 34.5 (Jan. 1995), minimum 32.3 (Oct. 1994). Temperature (0 m): average 13.4°C (1986–1993); maximum 24.8°C (Aug. 1990), minimum 4.8°C (Feb. 1986). Station substratum: St 1–3, rocks from sub-littoral zone with seaweed attached. St 4 and 5, raft for aquaculture: seaweeds present (*Undaria pinnatifida*, *Laminaria religiosa*), oysters, scallops, sea squirts (*Halocynthia roretzi*).

Seaweed was covered with a vinyl bag or mesh bag (mesh opening 40 µm) and collected. It was immediately fixed in 10% formalin sea water. Animals were removed from seaweed by washing and shaking. Copepods were preserved in 5% formalin sea water buffered with sodium tetraborate.

The seaweeds sampled at each of the stations and the number of copepods present (including larval stages) is shown in Table 1. A full analysis of the abundance, sex ratios and distribution of porcellid species among the various seaweeds will be published separately.

Measurements were made on formalin fixed paratype material, care being taken not to distort width of the body by pressure of the coverglass. To avoid errors that might be caused by the angle at which the caudal rami are held, body length was measured from anterior edge of rostrum to posterior extremity of the urosome (HARRIS and ROBERTSON, 1994).

Drawings have been made from dissections of paratype specimens. Labels on the illustrations explain some technical terms, but see HARRIS and ROBERTSON (1994) for a detailed account.

Samples with a large and representative population have been selected as type populations. In species where only a few specimens were found, specimens have been pooled to make the type population. From each type population one adult female has been selected as the holotype and one adult male as the allotype. The rest of the type population is regarded as paratype material. The holotype, allotype and some paratype specimens for each new species has been deposited in the National Science Museum, Tokyo (NSMT). Paratype material has been deposited in British Museum (Natural History) (BMNH), National Museum of New Zealand (NMNZ), Australian Museum, Sydney (AMS). The remainder of the paratype material and all the samples from the collecting stations are held by Dr N. IWASAKI, Usa Marine Biological Institute, Kochi, Japan.

### Systematics

Family Porcellidiidae SARS, 1904

Genus *Porcellidium* CLAUS, 1860

*Diagnosis.* Anterior of female cephalosome semicircular, rostrum prominent; male cephalosome truncated; hyaline border always present on cephalosome

Table 1. Data on Porcellidiidae collections from seaweeds at Kadonohama Bay, Ofunato, Iwate Prefecture, Japan.

Station & sample No.	Seaweed	No. of Porcellidiidae (per sample)	Total No. of copepods (per sample)
5-6 Oct. 1993			
1 1-1	<i>Grateloupia carnosa</i> <sup>1</sup>	754	932
1 1-2	<i>Laminaria religiosa</i> <sup>2</sup>	73	213
2 2-1	<i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	125	484
2 2-2	Sporophyte of <i>Undaria pinnatifida</i> <sup>2</sup>	25	312
2 2-3	<i>Zostera marina</i> <sup>4</sup>	411	1237
3 3-1	<i>Undaria pinnatifida</i> <sup>2</sup>	92	711
3 3-2	<i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	235	635
3 3-3	<i>Neodilsea yendoana</i> <sup>1</sup>	217	528
3 3-4	<i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	232	473
3 3-5	<i>Undaria pinnatifida</i> <sup>2</sup> , <i>Grateloupia carnosa</i> <sup>1</sup> and <i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	207	995
4 4'-1	<i>Chondrus ocellatus</i> <sup>1</sup> , <i>Grateloupia carnosa</i> <sup>1</sup> and <i>Grateloupia turuturu</i> <sup>1</sup>	2704	2706
4 4'-2	<i>Laminaria religiosa</i> <sup>2</sup>	10	82
5 5'-1	<i>Grateloupia turuturu</i> <sup>1</sup> and <i>Grateloupia</i> spp. <sup>1</sup>	50914	50916
5 5'-2	<i>Neodilsea yendoana</i> <sup>1</sup>	27976	28002
5 5'-3	<i>Codium fragile</i> <sup>3</sup>	204	277
5 5'-4	<i>Ulva</i> sp. <sup>3</sup>	160	292
5 5'-5	Sporophyte of <i>Undaria pinnatifida</i> <sup>2</sup>	155	200
9 Dec. 1993			
1 1	<i>Rhodoglossum japonicum</i> <sup>1</sup>	422	504
2	<i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	10	266
3	? <i>Sargassum tortile</i> <sup>2</sup>	2	52
4	<i>Sargassum horneri</i> <sup>2</sup>	1	175
2 5	<i>Sargassum horneri</i> <sup>2</sup>	23	709
6	<i>Lomentaria catenata</i> <sup>1</sup>	7	504
7	<i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	85	690
8	<i>Sargassum serratifolium</i> <sup>2</sup>	25	909
3 9	<i>Rhodoglossum japonicum</i> <sup>1</sup> and <i>Chondrus verrucosa</i> <sup>1</sup>	59	3227
10	<i>Eisenia bicyclis</i> <sup>2</sup>	1397	1435
11	<i>Cystoseira hakodatensis</i> <sup>2</sup>	7	1006
12	<i>Sargassum sagamianum</i> var. <i>yezoense</i> <sup>2</sup>	106	913

<sup>1</sup> red algae, <sup>2</sup> brown algae, <sup>3</sup> green algae, <sup>4</sup> marine phanerogams.

and metasomal epimera; ducts from marginal glands open dorsal to hyaline border; dorsal pits usually conspicuous, but may be reduced or, if absent, no honeycomb present; female urosome broad, bordered with setules, divided into anterior and posterior lobes by lateral notch or scar, posterior lobe broad (not pointed), caudal arch of urosome deep, encloses most if not all of caudal rami; female caudal rami rectangular, square in male,  $\alpha$  and  $\beta$  setae not close together,

(a measure of "closeness" is given by the ratio of ramus length to distance between  $\alpha$  and  $\beta$  setae, i.e.,  $L/(\alpha - \beta) > 5$  = setae close together,  $L/(\alpha - \beta) < 5$  = setae not close together),  $\beta$  usually about middle of ramus but may be sub-terminal (i.e., close to  $\gamma$ ),  $\gamma$  seta on terminal border close to seta 2 (not lateral or ventral), terminal setae 2 & 3 close together; male antennule without anterior comb on accessory lobe; first seta of mandibular palp slender; maxillule endopod with 6 setae, exopod with 1 seta; maxilliped basis with fimbriate process, fimbriate rounded coxal lobe; P1 without conspicuous or extensive denticulate peg fields on endopod; male P2 endopod with 2 plumose terminal setae (P2 = 1 : 2 : 0, 2, 0); male P5 rhomboid with 6 terminal setae; female P5s without ventral expansion, do not extend beyond urosome or touch one another posteriorly.

*Remarks.* The genus *Porcellidium* is distinguished from other genera from Japan (HARRIS and IWASAKI, 1996) by features of the male antennule, female P 5 and caudal ramus. HARRIS and ROBERTSON (1994) divided the species of *Porcellidium* into three sub-groups based on caudal setation and structure of the male antennule. The three species described here from Iwate do not have a ventral blade on the male's antennule and so they have been placed in the 'Naviculum' sub-group.

*Species Composition.* 'Hormosirii' sub-group: *Porcellidium rubrum* PALLARES, 1966; *P. hartmannorum* TIEMANN, 1978; *P. algoense* HICKS, 1982; *P. hormosirii* HARRIS et ROBERTSON, 1994; *P. ocellum* HARRIS et ROBERTSON, 1994; *P. pulchrum* HARRIS et ROBERTSON, 1994; *P. erythrogastrum* HARRIS et ROBERTSON, 1994.

'Fimbriatum' sub-group: *Porcellidium fimbriatum* CLAUS, 1889; *P. londonii* HARRIS, 1994.

'Naviculum' sub-group: *Porcellidium viride* (PHILIPPI, 1840); *P. sarsi* (CLAUS, 1863); ? *P. erythrum* HICKS, 1971; *P. naviculum* HARRIS et ROBERTSON, 1994; *P. phyllosporum* HARRIS et ROBERTSON, 1994; *P. ofunatense* n. sp.; *P. kiiroum* n. sp.; *P. akashimum* n. sp.

### *Porcellidium ofunatense* n. sp.

(Figs. 2-5)

*Porcellidium* sp., MIZUNO & GAMÔ, 1991, p. 11-23.

*Type material.* Holotype, adult female with egg mass removed, NSMT-Cr 11915, length 0.95 mm. Allotype, adult male, NSMT-Cr 11916, length 0.69 mm. Paratype specimens: 20 ♀ + 20 ♂ plus juvenile stages, NSMT-Cr 11917, slide (1454, 2 ♀, 2 ♂), NSMT-Cr 11918; 25 ♀ + 25 ♂ + juveniles, slide (1453), BMNH; 20 ♀ + 20 ♂ + juveniles, slide (1452), AMS; 10 ♀ + 10 ♂, NMNZ.

Type population from *Grateloupia turuturu*, Station 5, sample number 5'-1,

Kadonohama Bay, Ofunato, Iwate Prefecture, Japan, collected by N. IWASAKI, 6.10.93.

*Diagnosis.* Adult female. Pale orange, antennules, P5, urosome and caudal rami orange brown; mean length 0.94 mm, rostrum width 0.14–0.15 mm, cephalosome width to rostrum ratio 4.2; urosome with lateral notch and scar, posterior lobe rounded posteriorly; caudal ramus rectangular ( $L/w=2.4$ ),  $\alpha$  seta  $1/3$  down ramus,  $\beta$  seta about  $2/3$  down ramus, terminal setae 1–4 pinnate, 2 & 3 close together at middle of posterior border, 3 slender, 4 set in from medial edge; P5 first dorsal seta very small, second & third conspicuous.

Adult male. Colouration as for female; mean length 0.68 mm; lateral angle of antennule socket visible from above, shoulders rounded; antennule accessory lobe claw-like without comb, ventral blade absent.

*Dimensions.* Females. Mean length 0.94 mm (S.D.=0.027, N=15), cephalosome width 0.61 mm (S.D.=0.015, N=15), body length to width ratio 1.55. Rostrum 0.14–0.15 mm wide, body width to rostrum ratio 4.2. Urosome width to length ratio 1.45. Caudal ramus length to width (maximum) ratio 2.4.

Males. Mean length 0.68 mm (S.D.=0.012, N=17), cephalosome length 0.39 mm, width 0.49 mm (S.D.=0.014, N=17), body length to width ratio 1.39.

*Description.* Adult female (Fig. 2A). Colouration; very pale orange, but on most individuals heavily sclerotised parts are a darker orange-brown (i.e., antennules, antennule sockets, trabeculae, perimeter of cephalosome and metasomal segments, articulation between segments, P5s, urosome and caudal rami appear orange-brown). Anterior of cephalosome semicircular. The hyaline border  $15\ \mu\text{m}$  wide, has a vacuolate appearance (Fig. 3G), eight sensory setae lie in plane of hyaline border on each side of the cephalosome. Dorsal pits small ( $2\ \mu\text{m}$ ). Rostrum with anterior hyaline border, prominent, projects about  $1/3$  of its width.

Urosome (Fig. 2D) broad with notch and scar, anterior lobe with fine setules, posterior lobe rounded posteriorly, bordered with stronger setules, caudal arch deep (almost half length of urosome).

Caudal ramus (Fig. 2C) rectangular, posterior medial corner bevelled, bordered with setules;  $\alpha$  seta  $1/3$ ,  $\beta$  seta about  $2/3$  down ramus,  $\gamma$  on posterior border, terminal setae 1–4 pinnate, 2 & 3 close together, finely pinnate, 3 slender, terminal fringe of fine setules between 2 & 4.

Limbs typical of family. Geniculate setae of antenna articulate, plain, claw comb-like almost as long as adjacent geniculate seta (Fig. 3B, C). P1 with very small patch of pegs at lateral end of fimbriate crescent. P3 sabre-like spinous seta slightly longer than endopod (1.1:1). First (proximal) dorsal seta on P5 very small, second & third large (Fig. 4E, G).

Adult male (Fig. 2B). Colouration as for female except P5s which are not orange-brown. Cephalosome truncated with bulge in midline, shoulders

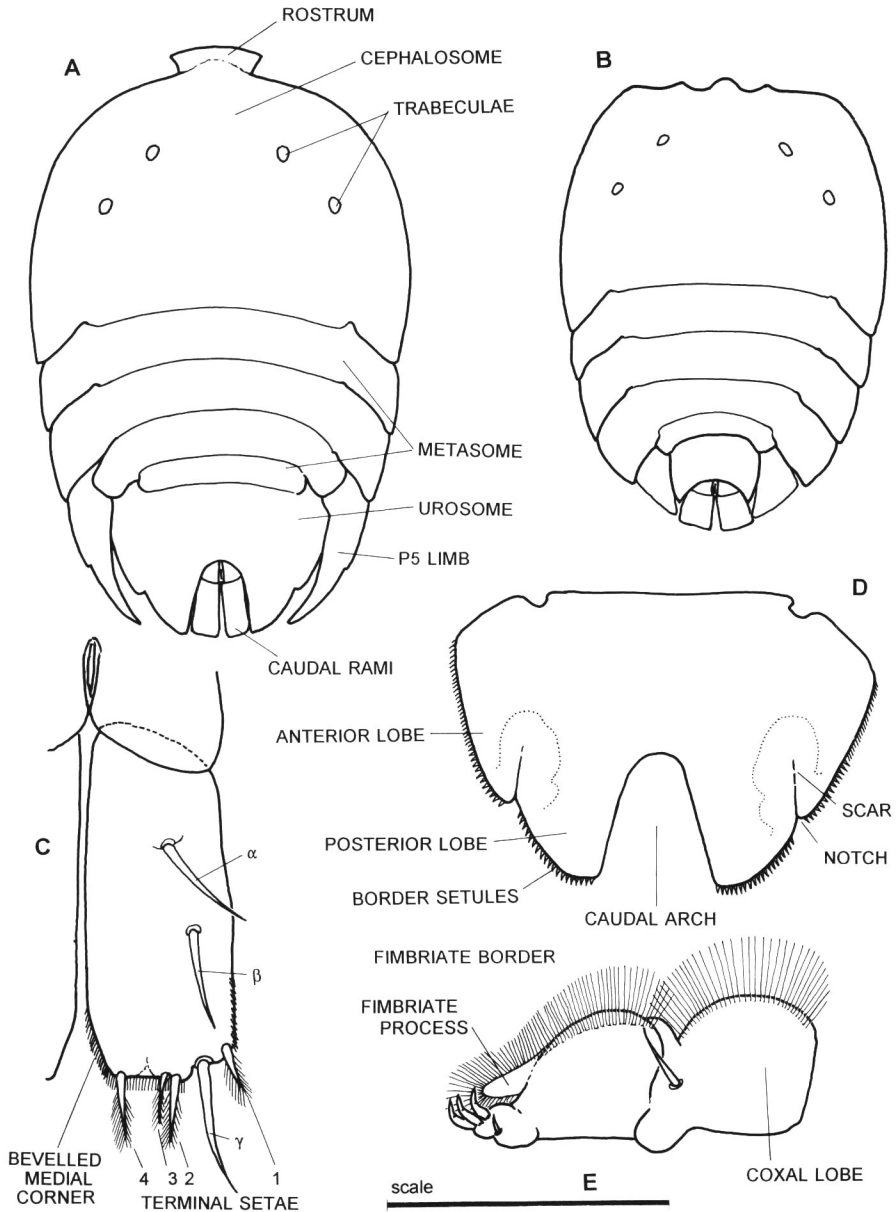


Fig. 2. *Porcellidium ofunatense*. A. Female. B. Male. C. Right caudal ramus. D. Female urosome. E. Maxilliped. Scale bar: A, B=0.45 mm; C, E=0.082 mm; D=0.265 mm.

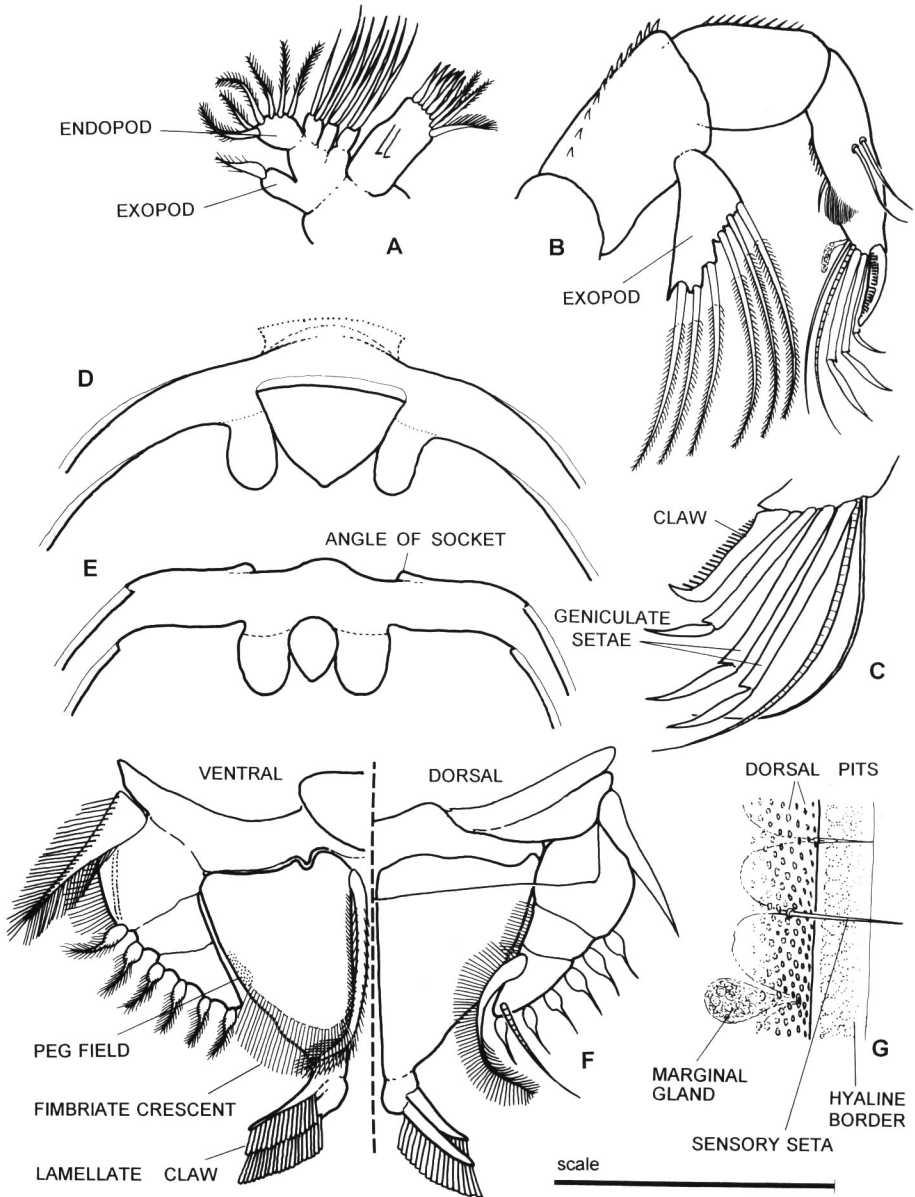


Fig. 3. *Porcellidium ofunatense*. A. Maxillule. B. Antenna. C. Geniculate setae of antenna (enlarged). D. Anterior of female cephalosome, dorsal and ventral focus. E. Anterior of male cephalosome, dorsal and ventral focus. F. P1, ventral and dorsal view. G. Edge of cephalosome showing hyaline border. Scale bar: A, B=0.082 mm; D, E=0.265 mm; C, G=0.06 mm; F=0.15 mm.



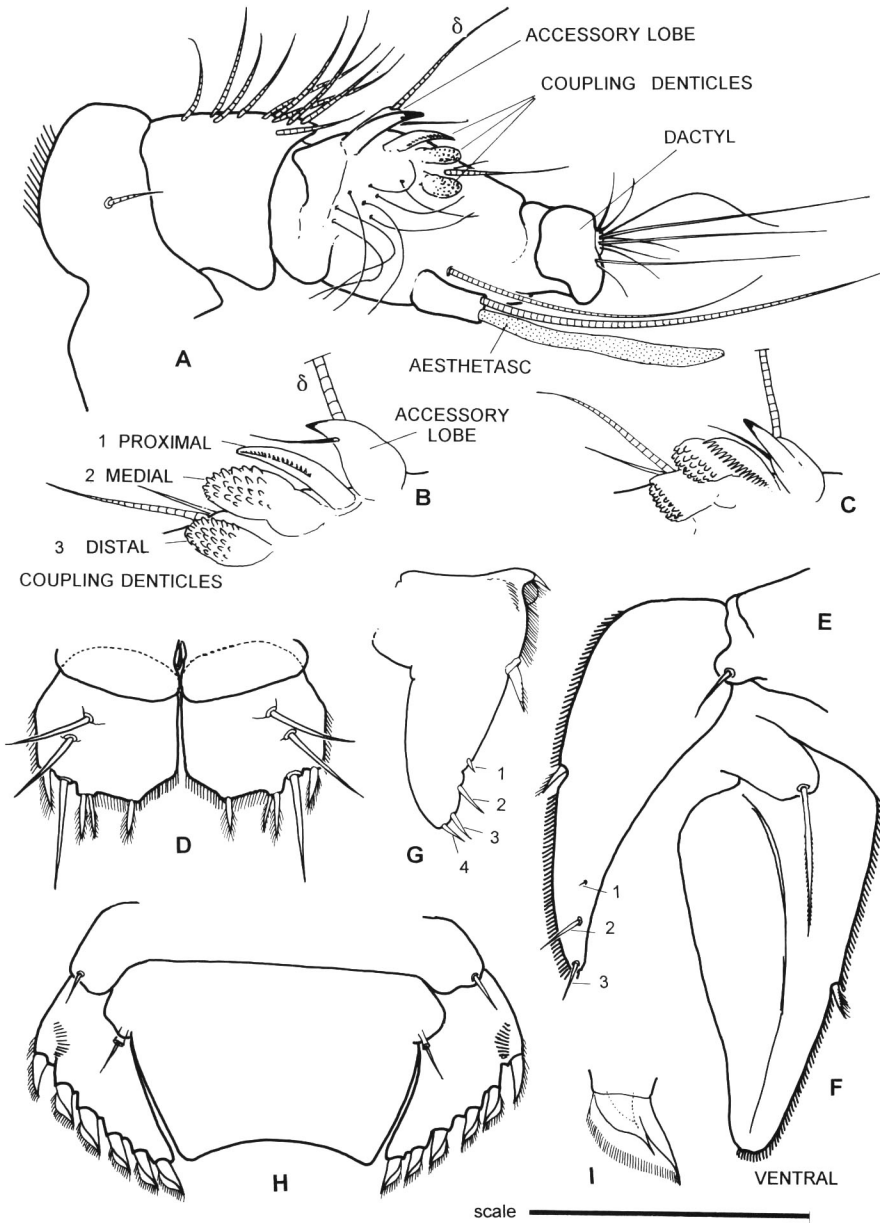


Fig. 4. *Porcellidium ofunatense*. A. Male antennule, ventral view. B, C. Coupling denticles on antennule enlarged (seen from different angles). D. Male caudal rami. E, F. Female P5, dorsal and ventral view. G. P5 of stage V juvenile female. H. Male urosome and P5s. I. Terminal seta of male P5. Scale bar: A, D=0.082 mm; E, F=0.19 mm; G=0.135 mm; H=0.15 mm.

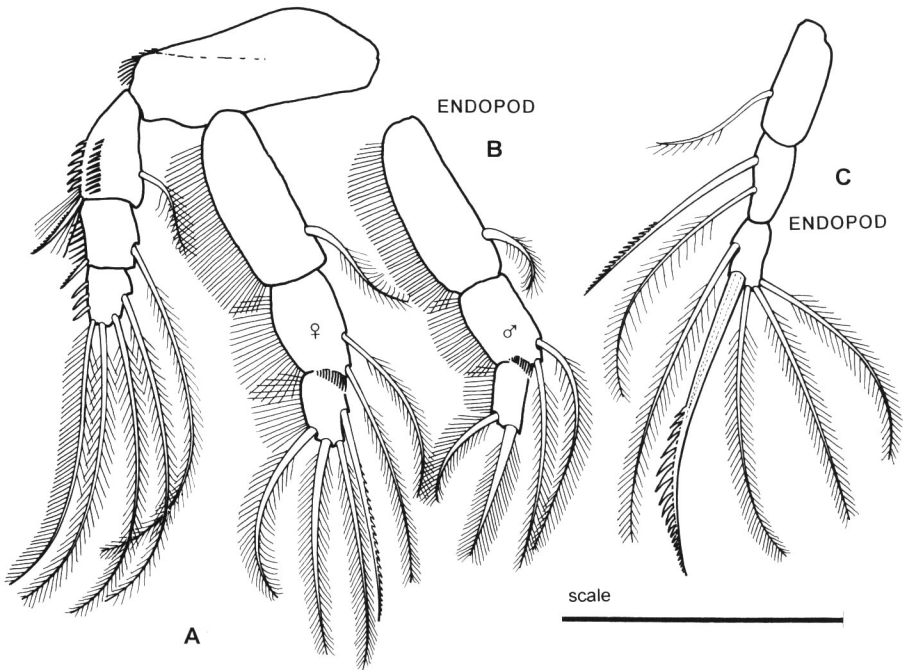


Fig. 5. *Porcellidium ofunatense*. A. Female P2. B. Endopod of male P2. C. Endopod of female P3. Scale bar: A, C=0.15 mm; B=0.135 mm.

rounded (Fig. 2B, 3E), lateral angle of antennule socket visible from above.

Caudal rami sub-quadrangle ( $L/w=0.85$ ), setation as for female.

Antennule (Fig. 4A), accessory lobe claw-like, proximal coupling denticle with serrated edge, medial and distal denticles denticulate pads (Fig. 4B, C), ventral blade absent.

*Remarks.* *Porcellidium ofunatense* has been named from the locality of the type specimens.

MIZUNO and GAMÔ (1991) have given an illustrated description of the adult, larval and juvenile stages of an unnamed species of *Porcellidium* which fits the above description of *P. ofunatense*. The two species are considered synonymous.

*Distribution and abundance.* At Kadonohama Bay *Porcellidium ofunatense* is the most abundant species. Dense populations are found on *Grateloupia carnosa* and *Neodilsea yendoana*, but small numbers may be found on *Laminaria religiosa*, *Undaria pinnatifida* and *Ulva* sp. It is also known from Sagami Bay and may be widely distributed in temperate waters of Japan.

*Porcellidium kiiroum* n. sp.

(Figs. 6-7)

*Type material.* Holotype, adult female with egg mass removed, NSMT-Cr 11919, length 0.81 mm. Allotype, adult male, NSMT-Cr 11920, length 0.57 mm. Paratype specimens: 5 ♀ + 5 ♂, NSMT-Cr 11921, slide (1459, 2 ♀, 1 ♂), NSMT-Cr 11922; 4 ♀ + 3 ♂, slide (1469), BMNH; 3 ♀ + 2 ♂, slide (1470), AMS; 3 ♀ + 2 ♂, NMNZ.

Type material from *Ulva* sp., Station 5, sample number 5'-4, Kadonohama Bay, Ofunato, Iwate Prefecture, Japan, collected by N. IWASAKI, 6.10.93.

*Diagnosis.* Adult female. Lemon yellow; mean length 0.81 mm, rostrum width 0.14 mm, cephalosome width to rostrum ratio 3.6; urosome with notch and cleft, anterior and posterior lobe bordered with strong setules, medial corners angular, not rounded; caudal rami rectangular ( $L/w=2.5$ ), lateral corner emarginate, medial corner slightly bevelled,  $\beta$  seta mid-way down ramus, terminal setae 1-4 pinnate, seta 3 small, close to 2; no peg field on P1 endopod, conspicuous crescent of setules on proximal article of exopod; apex of P5 pointed, first dorsal seta very small, 2 & 3 well developed, apical seta small.

Adult male. Colouration as for female; mean length 0.58 mm; lateral angle of antennule socket visible from above, shoulders rounded; accessory lobe of antennule not claw-like, ventral blade absent.

*Dimensions.* Females. Mean length 0.81 mm (S.D.=0.013, N=10), cephalosome width 0.51 mm (S.D.=0.013, N=10). body length to width ratio 1.59. Rostrum 0.14 mm wide, body width to rostrum ratio 3.6. Urosome width to length ratio 1.4. Caudal ramus length to width ratio 2.5.

Males. Mean length 0.58 mm (S.D.=0.012, N=14), cephalosome length 0.34 mm, width 0.44 mm (S.D.=0.013, N=14), body length to width ratio 1.32.

*Description.* Adult female (Fig. 6A). Colour lemon yellow. Anterior outline of cephalosome semicircular. Hyaline border 10  $\mu$ m wide, eight sensory setae lie in plane of hyaline border on each side of cephalosome. Dorsal pits 4-5  $\mu$ m, conspicuous. Rostrum with anterior hyaline border, projects about 1/5 of its width.

Urosome (Fig. 6B) broad with notch and cleft between lobes, anterior and posterior lobes bordered with strong setules, posterior lobe rounded, medial corner not rounded-almost a right angle. Caudal arch deep (2/5 length of urosome).

Caudal rami (Fig. 6E) rectangular, sides parallel, external corner emarginate, medial corner slightly bevelled with border of setules;  $\alpha$  seta about 1/4 and  $\beta$  seta half way down ramus, terminal setae finely pinnate, 2 & 3 close together, 3 small, 4 set in from bevel, terminal fringe of setules present (Fig. 6G).

Limbs typical of family. Geniculate setae of antenna articulate, plain, claw

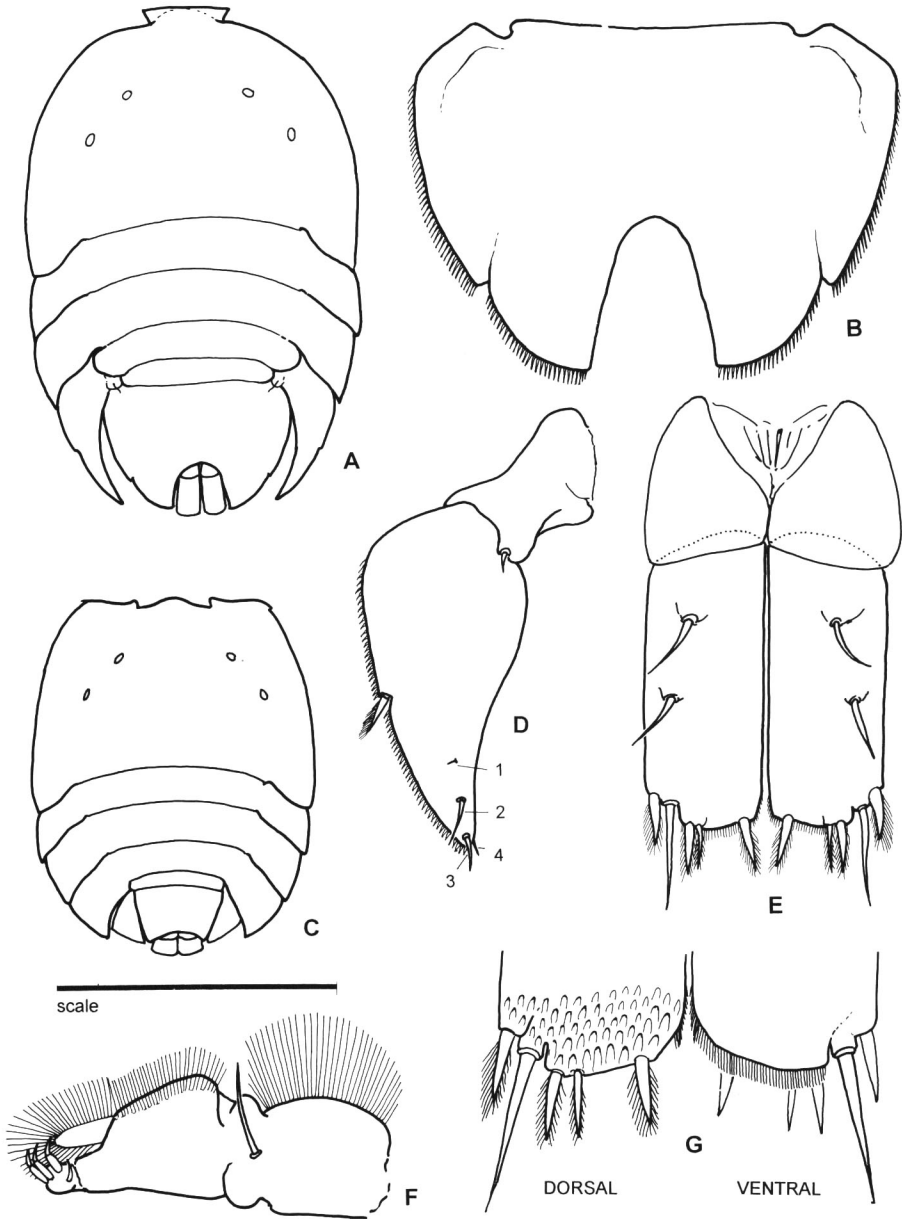


Fig. 6. *Porcellidium kiiroum*. A. Adult female. B. Female urosome. C. Adult male. D. P5 dorsal view. E. Female caudal rami. F. Maxilliped. G. Terminal setae of caudal rami, enlarged. Scale bar: A, C=0.45 mm; B, D=0.19 mm; E, F=0.082; G=0.06 mm.

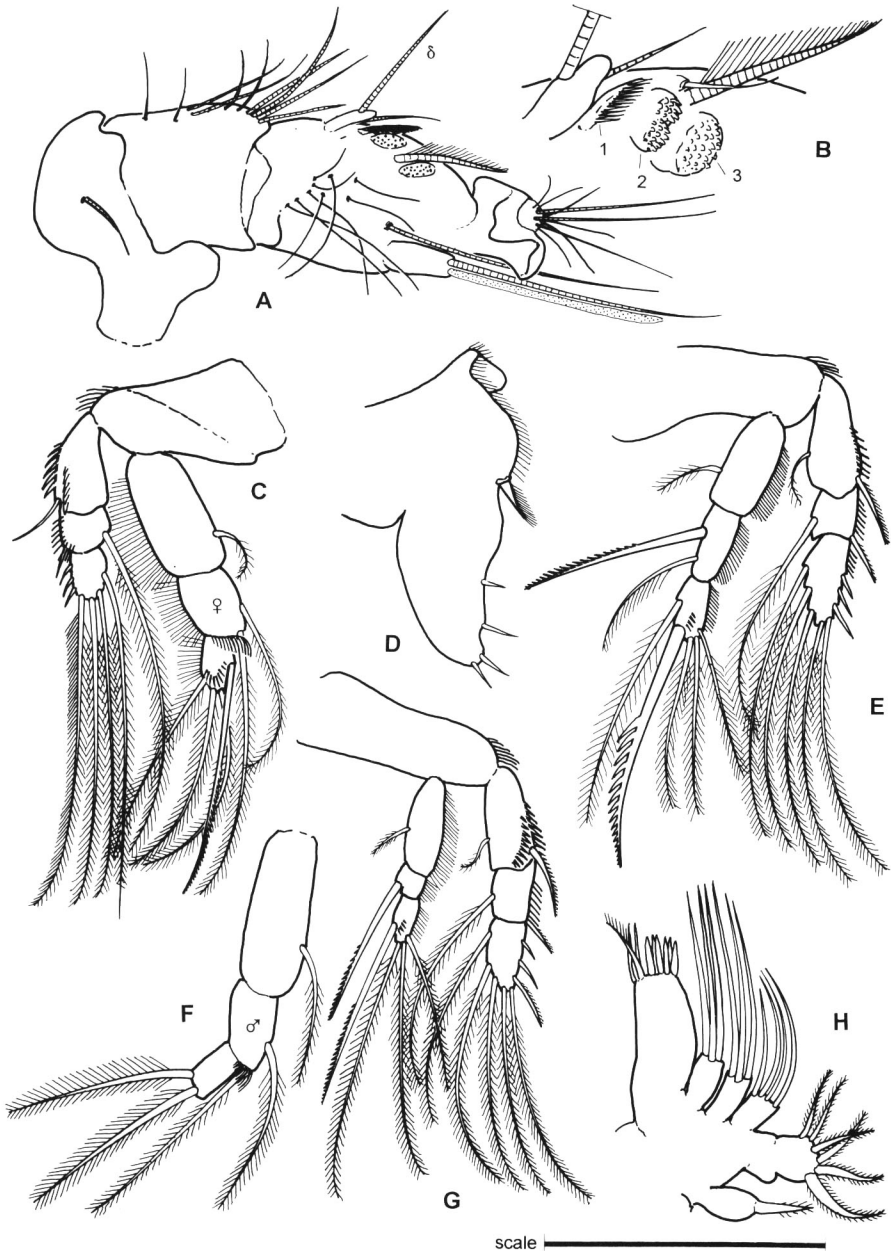


Fig. 7. *Porcellidium kiiroum*. A. Male left antennule, ventral view. B. Enlargement of coupling denticles. C. Female P2. D. P5 of stage V juvenile female. E. P3. F. Male P2 endopod. G. P4. H. Maxillule. Scale bar: A=0.082 mm; C, E, G=0.15 mm; D=0.1 mm; F=0.135 mm; H=0.06 mm.

comb-like. P1 with prominent row of "zipper-like" denticles parallel to edge of first article of exopod, no peg fields on endopod. P2 endopod with serrulate spinous seta + three plumose setae on distal article (Fig. 7C). Sabre-like spinous seta on P3 same length as endopod (Fig. 7E). P5 lanceolate, first dorsal setule very small, 3 close to small apical seta (Fig. 6D). Stage V juvenile female P5 with fine setules anteriorly, 4 plain postero-lateral setae (Fig. 7D).

**Adult male** (Fig. 6C). Colouration, hyaline border and dorsal pits as for female. Cephalosome truncated anteriorly, lateral corners of antennule sockets visible from above, shoulders rounded.

Caudal rami quadrate, setation as for female.

Antennule (Fig. 7A), accessory lobe without claw, proximal coupling denticle pinnate, medial and distal denticles denticulate pads associated with short plumose seta (Fig. 7B), dactyl short, hooked distally, ventral blade absent.

*Remarks.* The species is named from its bright yellow colour (Japanese *ki* = yellow + *iro* = colour).

*Distribution and abundance.* The small type population (28 adults) was collected from *Ulva*, but isolated individuals have been found on *Undaria pinnatifida*, *Grateloupia carnosa* and *Neodilsea yendoana*. The geographical distribution of *P. kiiroum* is not known.

### *Porcellidium akashimum* n. sp.

(Figs. 8–10)

*Type material.* Holotype, recently metamorphosed adult female without egg mass, NSMT-Cr 11923, length 0.83 mm. Allotype, adult male, NSMT-Cr 11924, length 0.69 mm. Paratype specimens: 10 ♀ + 10 ♂ plus juvenile stages, NSMT-Cr 11925, slide (1460, 2 ♀, 1 ♂), NSMT-Cr 11926; 5 ♀ + 4 ♂, slide (1471), BMNH; 3 ♀ + 2 ♂, slide (1473), AMS; 3 ♀ + 2 ♂, NMNZ.

Type population from *Eisenia bicyclis*, Station 3, sample number 10, Kadonohama Bay, Ofunato, Iwate Prefecture, Japan, collected by N. IWASAKI, 9.12.93.

*Diagnosis.* **Adult female.** Yellow-orange with red dorsal stripe; mean length 0.84 mm, width to rostrum ratio 4.7; medial anterior bulge of cephalosome obscures rostrum from above; urosome with notch and cleft, anterior and posterior lobes bordered with strong setules, posterior lobe rounded, medial corner (apex) rounded; caudal rami rectangular, emarginate, medial corner rounded, terminal seta 4 set in from corner,  $\beta$  seta about 2/3 way down ramus, terminal setae pinnate, 2 & 3 close together; no peg field on P1 endopod; P5 with dorsal seta 1 very small, 2 & 3 long, apical seta small.

**Adult male.** Colour as for female; mean length 0.69 mm; cephalosome truncated, strongly bowed in mid-line obscuring lateral angle of antennule sockets and first segment of antennule, shoulders angular; antennule proximal coupling

denticle long claw with serrulate edge, ventral blade absent.

*Dimensions.* Females. Mean length 0.84 mm (S.D.=0.011, N=15), cephalosome width 0.54 mm (S.D.=0.013, N=15), body length to width ratio 1.56. Rostrum 0.12 mm wide, body width to rostrum ratio 4.7. Urosome width to length ratio 1.6. Caudal ramus length to width ratio 1.95.

Males. Mean length 0.69 mm (S.D.=0.012, N=15), length of cephalosome 0.42 mm, width 0.48 mm (S.D.=0.009, N=15), body length to width ratio 1.4.

*Description.* Adult female (Fig. 8A). Colour yellow-orange with red dorsal band running from rostrum to caudal rami. Anterior of cephalosome semicircular with medial bulge that obscures rostrum from dorsal view, edge of cephalosome in region of shoulders reflexed ventrally (Fig. 9A). Anterior border of rostrum reflexed ventrally (Fig. 9A). Hyaline border striated, 13  $\mu$ m wide (Fig. 9F) (this feature may be obscured by suctorian protozoans, but is clearly visible on newly metamorphosed animals), 8 sensory setae in plane of hyaline border on each side of the cephalosome. Dorsal pits small (1.5  $\mu$ m) near edge of cephalosome, absent dorsally. Numerous dorsal sensory setae and cup shaped sense organs (Fig. 9G, H).

Urosome (Fig. 8D, B) broad with deep notch and cleft between lobes, anterior and posterior lobes bordered with strong setules, posterior lobe rounded, with two sensory setae on border, medial corner rounded, caudal arch deep (almost 1/2 length of urosome).

Caudal rami (Fig. 8E) rectangular, lateral corner emarginate, medial corner rounded with border of setules,  $\alpha$  seta about 2/5 and  $\beta$  seta 2/3 way down ramus, terminal setae fine pinnate, 2 & 3 close together, 3 smaller, 4 set in from corner, terminal fringe of setules present.

Limbs typical of family. Geniculate setae of antenna plain, claw fine comb-like. Maxilliped as shown in Figure 10A. No peg field on P1 endopod, ridge parallel to edge of first article of exopod plain, not denticulate. Sabre-like spinous seta on P3 equal to length of endopod (1:1). P5 (Fig. 9C, D) lanceolate, dorsal seta 1 very small, setae 2 and 3 long, equal in size, apical seta small (Fig. 9E).

Adult male (Fig. 8C). Colouration and dorsal pits as for female. Anterior of cephalosome truncated. Anterior medial bulge obscures the lateral angle of antennule socket and first article of antennule (Fig. 9B), shoulders angular (almost right angle), edge of cephalosome in region of shoulder reflexed ventrally (Fig. 9B).

Caudal rami sub-quadrangle (L/w=0.75), setation as for female (Fig. 10G).

Antennule (Fig. 10B), seta on first segment plain, no ventral blade, peg-like protrusion from sclerite in joint between segment 2 and the compound segment (Figs. 10B, D), proximal coupling denticle large, curved claw with fine serrulate edge (this denticle does not project forwards but lies almost parallel to anterior

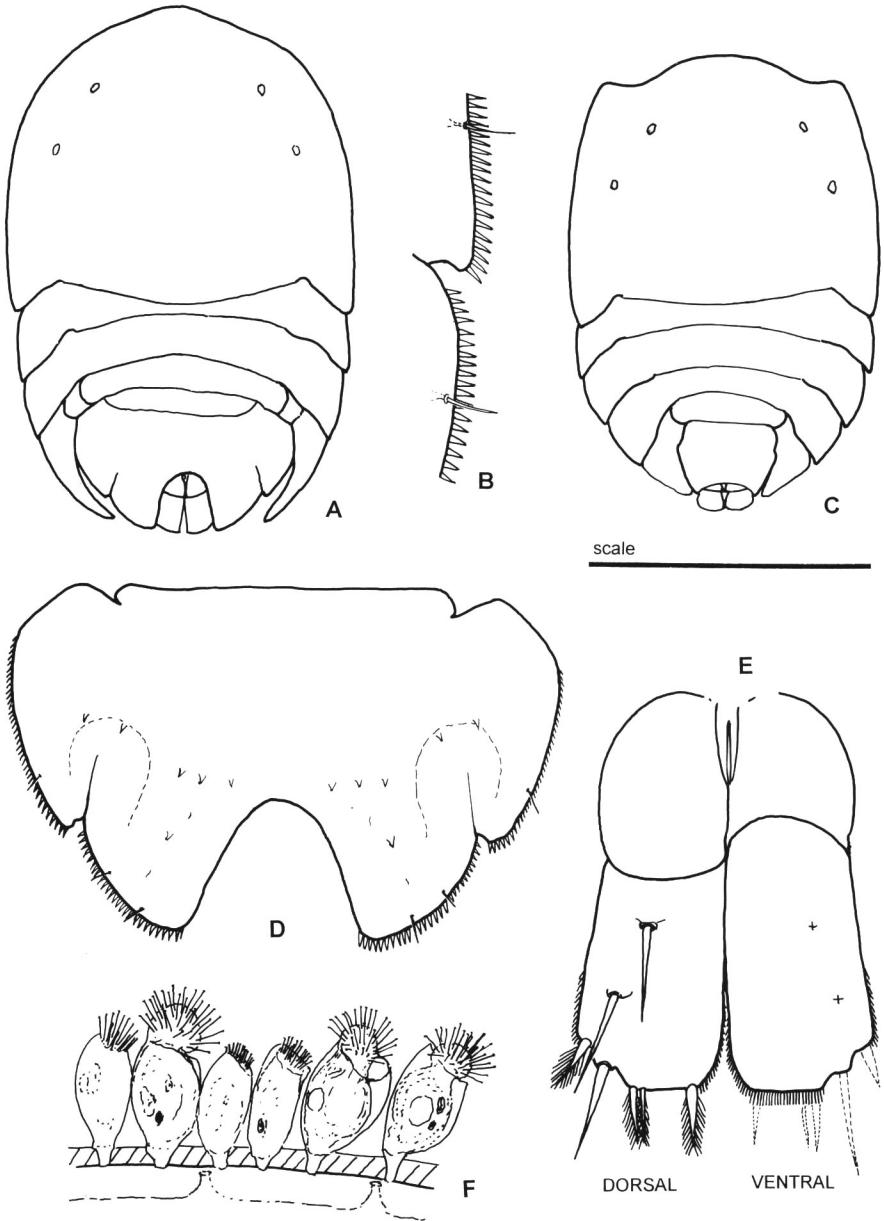


Fig. 8. *Porcellidium akashimum*. A. Adult female. B. Detail of notch and cleft in female urosome. C. Adult male. D. Female urosome. E. Caudal rami. F. Thecate suctorian protozoans attached to border of cephalosome. Scale bar: A, C=0.45 mm; B, E, F=0.082 mm; D=0.19 mm.



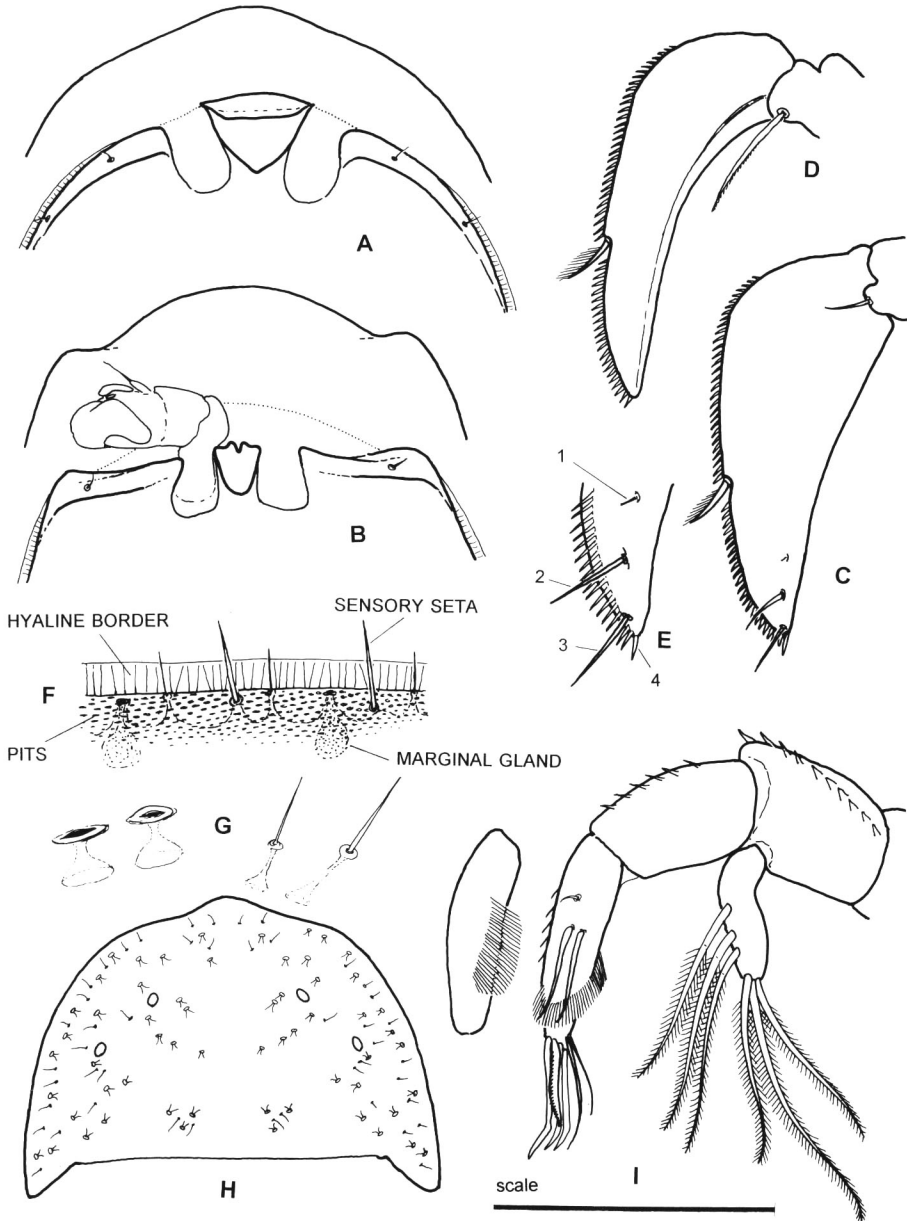


Fig. 9. *Porcellidium akashimum*. A. Anterior edge of female cephalosome, dorsal and ventral focus. B. Anterior edge of male cephalosome, dorsal and ventral focus. C. Female P5, dorsal view. D. P5 ventral view. E. Detail of P5 dorsal setae. F. Hyaline border showing striations. G. Sketch of sensory cups and setae. H. Female cephalosome showing pattern of sensory cups and setae. I. Antenna ventral view, dorsal view of terminal article. Scale bar: A, B=0.3 mm; C, D=0.15 mm; E, F, I=0.082 mm; H=0.45 mm.

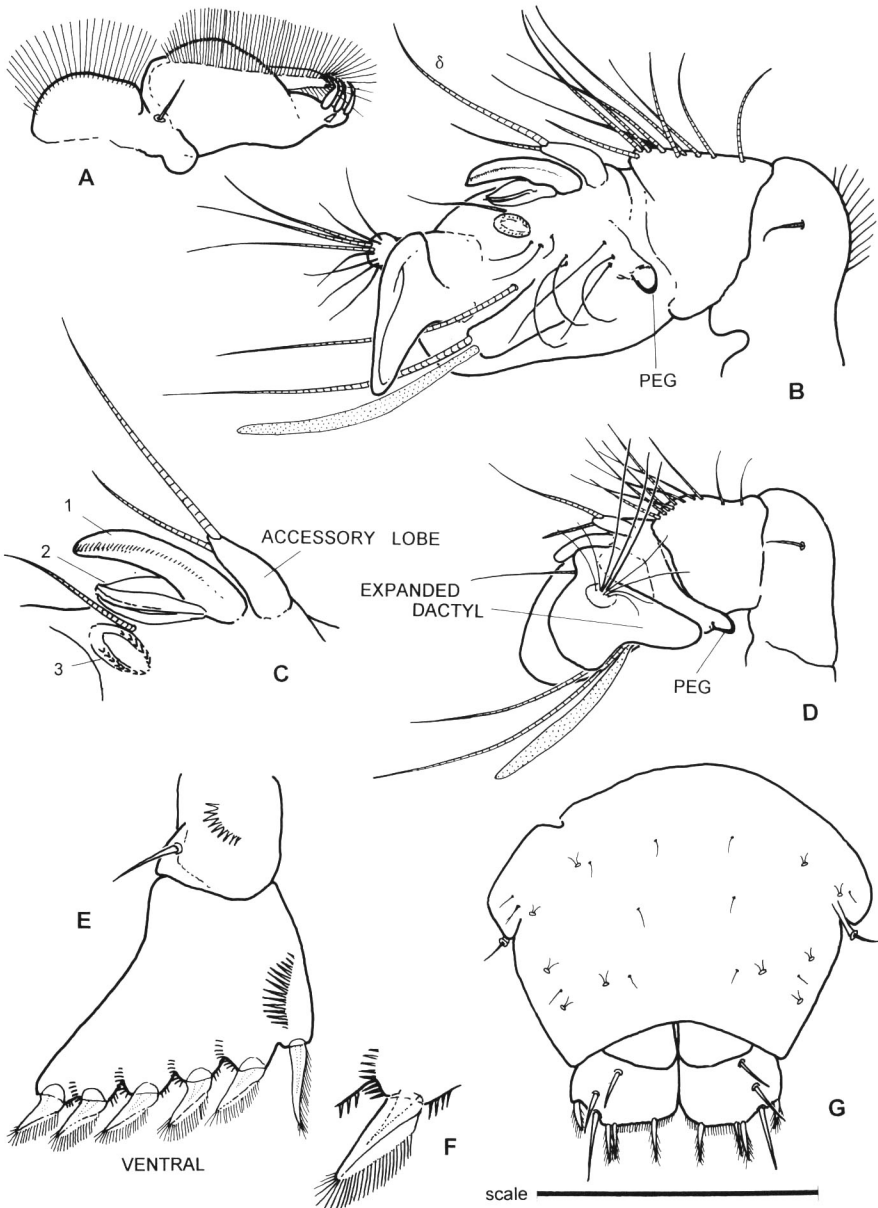


Fig. 10. *Porcellidium akashimum*. A. Maxilliped. B. Male right antennule, ventral view. C. Details of coupling denticles. D. Dactyl folded in clasp position. E. Male P5. F. Detail of P5 terminal seta. G. Male urosome and caudal rami. Scale bar: A, B, E, G=0.1 mm; C=0.06 mm; D=0.135 mm.

edge of antennule), medial denticle with knife-like ridge, distal denticle with double row of serrations (Fig. 10C), dactyl terminates in large flat expansion (Figs. 10B, D). P5 (Fig. 10E), first seta longer and thinner than remaining setae, proximal row of ventral setules plus short rows of setules at base of each terminal seta.

*Remarks.* This species has been named from the red band that runs down the middle of the back (Japanese *aka* = red + *shima* = stripe, band). This species displays the characteristics of the genus *Porcellidium*, in which it is placed. However, there are a number of unusual features:—rostrum obscured by anterior bulge of the cephalosome (also seen in *P. phyllosporum*), the anterior edge of the rostrum is reflexed ventrally, the hyaline border is striated, many cup-shaped sensory structures are present on the dorsal surface, the male antennule has a peg-like projection from the joint between the second and compound segments.

The colour pattern of *P. akashimum* closely resembles *P. pulchrum* and *Acutiramus rufolineatum* from the East coast of Australia (HARRIS and ROBERTSON, 1994). However, the former is easily distinguished by the obscured rostrum, striated hyaline border and short P5s which do not meet posterior to the caudal rami.

The entire population of adults and juvenile stages from sample 3–10 is heavily infected with a species of thecate suctorian protozoan (Fig. 8F) which attach to the perimeter of the cephalosome, metasome, P5s and caudal rami and obscure many taxonomic features. For this reason a newly metamorphosed female with few suctorians has been selected as the holotype.

*Distribution and abundance.* The sample from Station 10, washed from *Eisenia bicyclis*, contained over 300 adults of *P. akashimum* but no other species. Apart from 2 isolated individuals, *P. akashimum* has not been found on any of the seaweeds from other Stations at Kadonohama Bay. Its geographical distribution has not been determined.

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