Crab-associated amphipods from the Falkland Islands (Crustacea, Peracarida)

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Abstract
Four species of associated amphipods were collected from the lithodid crab Paralomis granulosa in the Falkland Islands: Jassa kjetilanna n. sp. (Ischyroceridae), Gammaropsis monodi (Schellenberg, 1931) (Phytiidae), Aora karibu n. sp. (Aoridae), and Paramoera falklandica n. sp. (Eusiridae s.l.). The Gammaropsis was also found on the majid crab Eurypodius lateilleii, where it seemed to be the only associate. A survey of all amphipod associations involving lithodid crabs is provided.

Keywords: Aora karibu n. sp., associated amphipods, Falkland, Gammaropsis monodi (Schellenberg), Jassa kjetilanna n. sp., Paralomis granulosa, Paramoera falklandica n. sp.

Introduction

During a visit to the Falkland Islands in October and November 2003, the first author had the chance to participate in a day of crab fishing on 29 October onboard the Island Maid out of Goose Green. This boat, owned by Falkland Fresh, was skippered by Kjetil Slettnes, and crewed by Anna Vader. They drew up baited traps from 20–35 m depth at various localities in Chocseul Sound (58–59°S, 52°W); the traps had been baited with mullet heads and other fish remains, and had been out for varying periods, up to a month.

We collected >300 kg of our target species, the lithodid Paralomis granulosa (Jacquinot, 1852); in addition, large numbers of undersized crabs were released, being below the minimum size of 70 mm carapace length (since then raised to 75 mm). Also all females had to be released, but being smaller than the males, most were below the minimum size anyway. The crabs were quite sluggish and therefore easy to handle, although they had the tendency to clench the peraeopods, which made it harder to find the associates. The amphipods on the crabs are extremely well camouflaged, so it was difficult to see them. Many got overlooked, and in addition the most common amphipod on the crabs was also the one that was hardest to spot, so that the ratios in which we found them were not the ratios in which they occurred on the crabs. A proper examination will therefore necessitate...
isolating large numbers of crabs individually, and removing the associates by other methods (freshwater rinses, formaldehyde, or some such method); there was no possibility for this during this short visit.

In the plastic bins in which the crabs were kept onboard and transported to the factory, there were large numbers of amphipods, and we collected several samples of these. These belonged mainly to three species: a very colourful—and individually most variable—eusirid with long antennae and legs, a red-striped ischyrocerid, and a brown-striped small photid, which was the least common, but the easiest to find. We found most amphipods on the proximal parts of the gnathopods of the crabs and the adjoining field of the cephalon around the mouthparts, with smaller numbers on the walking legs, and a very few beneath the abdomen. There were no signs whatsoever of tubes belonging to any of the three associated amphipod species.

Some of the traps, especially in the inner parts of Choiseul Sound, also contained the very “spider-like” spider crab *Eurypodius latreillet* Guerin, 1828, long-legged, with large bluish claws, and somewhat more active than the *Paralomis*. These crabs also had small associated amphipods, often on the joints between the leg segments or again around the mouthparts, but these turned out to be exclusively the small photid, the same species as associate no. 3 from the *Paralomis*. Again, the amphipods were so hard to find that no quantitative data could be obtained. We had the definite impression, though, that most crabs hosted amphipods, but that the numbers varied hugely between individuals.

Finally, we caught also three specimens (all ovigerous females) of a third spider crab, that unfortunately remains unidentified: brownish, smaller, with weak gnathopods, much hairier, and decorated with algae and sponges. On these crabs we found a few of the same associates as on *Eurypodius*.

**Material and methods**

In the field the amphipods were hand-picked from the crabs, or collected later from the bins in which the crabs had been temporarily stored. The living colours were noted the next day in the laboratory of the Falkland Fisheries Institute, after which the amphipods were fixed and stored in 75% ethanol.

In the laboratory the normal procedure was followed: direct observation and dissection under a Reichert and Wild M5 dissecting microscope with the specimens in alcohol and glycerol, followed by drawing from preparations (stored on slides in Faure’s medium) under a Wild M20 microscope.

**Taxonomy**

*Family ISCHYROCERIDAE*

*Jassa kjetilanna* n. sp.

(Figures 1–3)

*Type material*

Holotype: adult male, 6 mm, in alcohol; East Falkland, Choiseul Sound, 30 m, from *Paralomis granulosa*, 20 October 2003, caught in baited traps. Deposited at Tromsø Museum no. 13842. Paratypes: nine juveniles, one ovigerous female, 5 mm, from *Paralomis*
Figure 1. *Jassa kjetilanna* n. sp.: A1, A2=antenna 1, 2 male (×10); A1, A2 female (×10); Md=mandible, Mxp=maxilliped (×20); Mx1, Mx2=maxilla 1, 2 (×40).
Figure 2. *Jassa hjetilanna* n. sp.: Gn1, Gn2 = gnathopod 1, 2 female; Gn2 male young; Gn1, Gn2 male hyperadult (× 10).
Figure 3. Jassa hjetilanna n. sp.: P=peraeopod 3 (=4), 5, 6, 7 (×10); details P3 male distally, P7 male distally (×20); U=uropod 1, 2, Us=urosome (×20); U3 distally (×40).
granulosa, in alcohol; two slides of male, one of female and one of juvenile. One ovigerous female, 5 mm and one juvenile from *Eurypodiidae latreillei* in alcohol. All East Falkland, Choiseul Sound (58–59°S, 52°W), 30 m, 29 October 2003, A. and W. Vader leg., caught in baited traps. Deposited at Tromsø Museum no. 13843.

**Additional material**

Three specimens, Lively Sound, East Falkland, March 2003, A. Vader, from *Paralomis*; four specimens, Lively Sound, East Falkland, 15 April 2003, A. Vader, from *Paralomis* bins; 15 specimens, Lively Sound, East Falkland, 3 May 2003, A. Vader, from “spider crabs”, a few from bins; 26 specimens, Choiseul Sound, East Falkland, 29 October 2003. A. and W. Vader, from crab bins; five specimens, Choiseul Sound, East Falkland, 29 October 2003, A. and W. Vader, from *Paralomis granulosa*.

**Type locality**

East Falkland, Choiseul Sound.

**Diagnosis**

A *Jassa* species with robust antennae, unexpanded coxa 1, smooth basis on Gn2 and slightly subchelate pereopods without anteroproximally expanded propodus.

**Description**

**Male.** 6 mm. A1<A2. Antennae: A1 peduncle articles length 1<2=3, all with long ventral setae, longest distally. Flagellum five-articulate, article 1 ≈ the following; accessory flagellum two-articulate, ca half article 1 of flagellum. A2 more robust than A1; peduncle article 5>4, with simple setae only ventrally; flagellum four-articulate, all articles robust, quite setose; article 1 about 50% of flagellum.

Labium: rounded, epistome triangular, about the same length as labium. Mandible: palp broad, article 2 with facial and marginal rows of setae, but no fringe of setae on dorsal margin. Maxilla 1: palp without setae on article 1, article 2 with row of facial setae and six distal robust setae, outer plate with seven spinal teeth, inner plate short, without any setae. Maxilla 2 and maxilliped typical of the genus (see Figure 1).

Gnathopods: Gn1: coxa almost rhomboidal, not greatly expanded anteriorly, ventral margin straight; basis anterior margin with a few short setae on anterodistal margin, posterior margin smooth; merus as long as carpus; carpus with posterior lobe very weak, with anterodistal setae-cluster; propodus elongate, palm long (three-quarters length of posterior border), very oblique, weakly convex, delimited by single robust seta; dactyl long, adjoining palm. Gn2: coxa deeper than broad, ventral margin straight; basis short, anteroventral flange weak, with a few short setae; carpus short, cup-shaped with narrow, rounded, smooth lateral lobes; propodus very large, oval, palm long (80% of posterior margin), very oblique, with groups of plumose setae on hinge-tooth area, on thumb, and on palmar corner, the latter delimited by a few robust setae not on a protuberance; thumb short, blunt, gap between thumb and palm narrow; dactyl broad, inner margin crenulate, not clearly expanded near hinge-tooth area of palm.

Pereopods: P3–4 much smaller than P5–7. P3: merus with large posterior lobe, distally with group of setae, and reaching about 80% along carpus; propodus elliptical, with groups
of setae along anterior margin; dactyl falcate, ca three-quarters length of propodus. P5–7: basis expanded, merus with posteroventral lobe, propodus not markedly expanded anteriorly, but weakly subchelate, with strong robust setae distally on anteroventral margin; dactyl falcate, about one-third length of propodus. Uropod 1: peduncle with interramal spine short, less than one-third length of outer ramus; both rami with evenly spaced marginal spines and a few distal spines. U2 < U1, with interramal spine practically absent. U3: peduncle > rami, with two small distomedial and one anterodistal robust setae, outer ramus slightly bent, with one strong distal cusp, outer margin finely serrated; inner ramus with single apical spine. Telson short, entire, triangular, with one pair of lateral setae.

**Female.** Antennae similar to male. Gn1 basically similar to male. Gn2: basis with a row of short setae along anterior margin, anterodistal flange better developed than in male: propodus smaller than in male, similar in form, thumb absent, palm strongly convex, hinge-tooth area different in form.

**Colour in life.** The entire animal, including antennae and gnathopods, is covered by a pattern of reddish stripes and patches, rapidly fading in moribund or fixed specimens.

**Etymology**

The name “kjetilanna”, a noun in apposition, is chosen in honour of Kjetil Slettanes and Anna Vader, without whom the present material would not have been collected.

**Remarks**

Conlan (1990) made a monographic revision of the genus *Jassa*; no new species have been described since. In Conlan’s key the present material keys out to *J. thurstoni* Conlan, 1990, a species described from the South Orkney Islands in the Antarctic, but also found at South Georgia. However, *J. kjetilanna* differs from *J. thurstoni* a.o. in the following characters: (1) *J. kjetilanna* has the robust antennae normal in the genus, while *J. thurstoni* has unusually slender antennae (especially A2) for a *Jassa*; (2) in *J. thurstoni* coxa 1 is anteriorly expanded, in *J. kjetilanna* not at all; (3) in Gn2 of the male the thumb is less well developed and much more setose in *J. kjetilanna*; (4) the posterior peraeopods are more robust in *J. kjetilanna*, with a clear tendency towards a subchelate condition; (5) *J. thurstoni* has well-developed interramal spines on U1 (50% of inner ramus) and U2 (16%), while in *J. kjetilanna* these spines are much reduced (U1 30%) or almost absent (U2).

From the other *Jassa* species *J. kjetilanna* can be distinguished by the characters of Conlan’s (1990) identification key. The northern *J. pusilla* (G. O. Sars, 1894) is closest, but that is also a very slender species with conspicuously thin antennae. One other *Jassa* species has been recorded from the Falkland Islands, i.e. *J. alonsoae* Conlan, 1990. It differs from *J. kjetilanna* in many characters, such as the short A1, the short setation on A2 and the setose basis of Gn2.

This is not the first record of a *Jassa* species living in association with decapods. *Jassa pusilla* has several times been found together with slow-moving invertebrates (gastropods, hermit crabs), but this is at best a slight preference (cf. Vader and Myers 1996). Chilton (1912) mentioned the temporary association of what he called *Jassa falcata* with large crustaceans in New Zealand; it is unclear, however, which *Jassa* species he had at hand.
Interestingly, Monod (1926) briefly described a female “Jassa falcata” found on the carapace of *Eurypodiuss* in the Magellan Channels; from his figures of Gn2 and U3 this was not *J. kjetilanna*, but probably *J. alonsoae*.

**Family PHOTIDAE**

*Gammaropsis monodi* (Schellenberg, 1931)

(Figures 4–6)

*Eurystheus* sp. Monod 1926, p 60, Figure 57.
*Eurystheus monodi* Schellenberg 1931, p 238, Figure 121.
*Eurystheus eurypodii* K. H. Barnard 1932, p 231, Figure 145.
*Eurystheus Monodi* Ruffo 1949, p 56.
*Gammaropsis monodi* Barnard and Karaman 1991, p 191.

**Material examined**

Seven ovigerous females, 29 males and juveniles in alcohol, two slides deposited at Tromsø Museum (Norway), reg. no. 13844. Two males and two females deposited at Museo Civico di Storia Naturale, Verona (Italy), all collected East Falkland, Choiseul Sound, 30 m, from *Paralomis granulosa* and *Eurypodiuss latreilleii*, caught in baited traps, 29 October 2003, A. and W. Vader leg.

**Additional material**

One specimen, Lively Sound, East Falkland, March 2003, A. Vader, from *Paralomis*; 21 specimens, Choiseul Sound, East Falkland, 29 October 2003, A. and W. Vader, from crab bins; seven specimens, Choiseul Sound, East Falkland, 29 October 2003, coll. A. and W. Vader, from *Paralomis granulosa*.

**Diagnosis**

A *Gammaropsis* species with accessory flagellum, moderately acute epistome, triangular head lobes, rounded Cx1, Gn2 dactylus less than half length of propodus, U3 rami subequal to peduncle length.

**Description of Falkland material**

*Male.* 4–5 mm. Head with cephalic lobes triangular, pointed, eyes roundish, drop-shaped, black. A1 a little shorter than A2, both with few but long setae. Antennae: A1 with peduncle article 1 subequal to 3, article 2 almost twice as long, flagellum four-articulate; accessory flagellum two- to three-articulate, last article very short. A2 with peduncle articles 4 and 5 subequal, long, flagellum eight-articulate.

Mouthparts: upper lip with acute epistome, longer than labrum, reaching along insertion of antennae. Mandible: palp with article 3 almost as long as article 2. Maxilla 1: inner plate triangular, with a row of setules along margin; outer plate with seven pectinate robust setae, palp two-articulate, article 2 smooth except for distal setae: four robust pectinate setae, and two simple setae. Maxilla 2 plates of equal breadth, inner plate setose also on inner margin. Maxillilaped: in reasonable agreement with the figure provided by Monod: merus (first article of palp) triangular; carpus double length of propodus, dactylus three-quarters length.
Gammaropsis monodi (Schellenberg): head female (× 6, × 10); A2 = antenna 2 (× 10); Md = mandible, UL = upper lip, LL = lower lip (× 20); Md' = mandible detail, Mx1, Mx2 = maxilla 1, 2, Mxp = maxilliped (× 40).
of propodus; outer plate reaching half of carpus; inner plate reaching half of outer plate. Lower lip: with inner lobes.

Gnathopods: Gn1 coxa rectangular, distally rounded, carpus and propodus subequal in length, propodus oval, hind margin regularly rounded, palm scarcely defined and not delimited by spines, covering 75% of hind margin, dactyl long, narrow, falcate. Gn2 larger than Gn1, Cx2 similar to Cx1, but distally tongue-shaped, rounded, propodus 1.5× longer than carpus, broad and robust, palm almost transverse, with a right-angled to V-shaped indentation centrally, palmar angle not delimited by spines, but greatly and roundly expanded; dactyl broad and curved, shorter than palm.

Peraeopods: P4 coxa deep, rounded, covers ca two-thirds of basis; basis moderately expanded, merus with small distal lobe, with bunch of setae; propodus > carpus, dactyl falcate, ca two-thirds length of propodus. P5: basis greatly broadened, merus, carpus and propodus with stiff setae on posterior margin, propodus longer than carpus, dactyl falcate, 50–66% of propodus. P7: more slender than P3–6, basis moderately expanded, propodus twice length of carpus, dactyl falcate, ca two-thirds length of propodus.

Figure 5. *Gammaropsis monodi* (Schellenberg): Gn1=gnathopod 1 male (×20); Gn2 male (×10); Gn2’ male detail (×20); Gn1 female (×10); Gn2 female (×20).
Uropods moderately spinose. U1–2: peduncle shorter than outer ramus, with two marginal spines on distal half; interramal spine strong, about half length inner ramus; U3 peduncle as long as rami, rami subequal.

Telson entire, subquadrate, distally triangular, with one pair of long lateral setae.

Female. Ovigerous 3–3.7 mm. Basically as male, Gn1 similar to male, Gn2 with propodus less robust and more slender than in male, palm sinuously convex, palmar angle without the great rounded expansion.

Figure 6. *Gammaropsis monodi* (Schellenberg): Gn=gamathopod 2 female (×20); P=pereopod 4, 5, 7 (×10); Us=urosomite (×10, ×20).
Colour in life. The eyes are black. The colour pattern consists otherwise of many small brown dots, often vaguely arranged in stripes, over the entire body, including coxae and bases of the peraeopods. The colour persists some time in alcohol.

Distribution
Choiseul Sound (Falkland Islands), picked from *Eurypodius, Paralomis* and unidentified spider crab. Magellan Straits, from *Eurypodius* (Monod 1926; Barnard 1932), Beagle Channel (Ruffo 1949).

Remarks
In spite of the scantiness of the earlier descriptions, there is no doubt that our material belongs to *Gammaropsis monodi*: the animals were collected from the same host in the same geographic area, and the form of the male gnathopods is very characteristic. The specimen reported by Ruffo (1949) had “one enormous egg filling the marsupium”; this was probably a sphaeronellid copepod, as the species normally carries many small eggs.

The vast genus *Gammaropsis* is greatly in need of a revision. Several species in the genus associate regularly with large crustaceans, examples are *Gammaropsis (Podoceropsis) nitida* (Stimpson, 1853) in Europe on hermit crabs (cf. Vader 1971; Hoberg et al. 1982), *G. (P.) chionoecetophila* Conlan, 1983 on the Snow Crab *Chionoecetes opilio* in Canada (Steele et al. 1986) and on the Alaska King Crab *Paralithodes camtschatica* in Alaska (Kuris et al. 1991), and various *Gammaropsis* s. str. on large hermit crabs off east Australia (W. Vader, unpublished data).

**Family AORIDAE**

*Aora karibu* n. sp.
(Figures 7–9)

Type material
Holotype: one male 5.8 mm, together with *Gammaropsis*, East Falkland, Choiseul Sound, 30 m, from *Eurypodius latreillei*, caught in baited traps, 29 October 2003, A. and W. Vader leg. Deposited at Tromsø Museum as a slide 13845.

Type locality
Choiseul Sound, Falkland, from *Eurypodius*.

Diagnosis
A rather nondescript *Aora* with a not very setose second gnathopod, with merus long, acute and unadorned. Interramal spine on second uropod virtually absent.

Description
Male 5.8 mm. Body: dorsally smooth. Head with lateral lobe broadly rounded, eyes large, roundish, dark, largely on cephalic lobes. Epimeral plates 2–3 with small posterodistal tooth, Ep3 with posterior margin convex.
Figure 7. *Aora karibu* n. sp.: male habitus 5.8 mm; A=antenna 1, 2; head with lateral lobe (×10); all mouthparts (×20): Md=mandible from both sides; Mx=maxilla 1, 2; UL=upper lip; LL=lower lip.
Figure 8. *Aora karibu* n. sp.: Gn=gnathopod 1 (×10), enlargement (×20); Gn2 (×10), enlargement (×20); Mxp=maxilliped (×20), palp and inner plate in enlargement (×40); U=uropod 3 (×10), enlargement of proximal part of peduncle (×40).
Figure 9. *Aora karibu* n. sp.: P=peraeopod 3, 4, 5, 6 (×10); Ep=epimeral plate 2, 3 (×6); U=uropod 1, U2 right and left (×10); T=telson+U3 (×20); U3 rami distally, enlarged (×63).
Antennae: A1>A2, about as long as body; peduncle article 1 broader than articles 2 and 3, article 2>1>3; peduncle article 1 with a row of strong setae ventrally, article 2 with small groups of short setae both dorsally and ventrally, article 3 with distal setae only. Flagellum with 21 elongate articles, slender. Accessory flagellum thin, five-articulate. A2 with peduncle less slender than A1, articles 4 and 5 subequal, sparsely setose, flagellum shorter than article 5 of peduncle, nine-articulate.

Mouthparts typical for the genus (cf. e.g. Myers 1973). Mandible palp slender, length ratio articles 1:2:3 is 10:17:21. Maxilla 1 palp article 2 with eight robust setae. Maxilliped: palp carpus with acute falcate prolongation on the upper side, of about half length of propodus.

Gnathopods: Gn1>Gn2, with coxa moderately produced anteroventrally, basis with margins weakly convex, merus of typical Aora-form, the acute tip reaching just beyond the carpus, carpus and propodus broad, subequal in length, propodus with palm slightly oblique, palmar corner defined by acute, triangular, serrate "tooth", and strong robust seta, palm concave, with two further rounded "teeth" on proximal third; dactylus strong, falcate, much longer than palm. Gn2 with coxa sub-quadrate, with rounded corners, basis with posterior margin strongly convex, with a few long setae, carpus and propodus subequal in length, with many setae along posterior margin, propodus also medially setose. Palm oblique, slightly convex, demarcated by one strong and a few minor robust setae, dactyl falcate, as long as palm.

Peraeopods: P3–4 similar, coxae subquadrate, basis slender, with short setae on both margins and a few longer setae on posterior margin; propodus narrow, dactylus slender, ca 60% propodus. P5 shorter than P3–4, with basis broadened, and propodus longer than carpus; dactylus short, falcate. P6 long, slender; basis broadened, anterior margin crenulate, both margins with short marginal setae; length ratio merus: carpus: propodus is 40: 25: 50, dactylus ca 30% length of propodus, straight, slender, acute.

Uropods: U1 with peduncle slightly longer than rami, both with marginal robust setae;interrupt spine strong, >40% length of ramus, rami subequal. There is a pore, possibly the exit of a gland, near the basis of the peduncle (see Figure 8, with detail, and Figure 9). U2 with peduncle shorter than rami, interramal spine absent, outer ramus slightly shorter than inner. U3 with peduncle broad, clearly shorter than rami; one robust seta on each distal corner; rami with rounded tips, and long distal robust setae, as well as marginal ones; outer ramus with nail-like distal end which could be interpreted as a minute second article.

Telson fleshy, three-dimensional, with acute blade-like crests on either side leaving a V-shaped dorsal depression; on the inner margin with a number of long setae. When squashed the telson appears 25% "cleft", which, however, is not the case.

Gills on P2–7.

Etymology

Karibu, here used as a noun in apposition, signifies “welcome” in Swahili. Most appropriately, it is also the name of the most welcoming home of the Myers family in Fountaintown, Ireland, and the name is given in grateful appreciation of both the great hospitality that both authors have received there, and of the scientific help given us by Alan Myers, the world authority on the family Aoridae.

Discussion

Myers and Moore (1983) presented a key to the 14 Aora species (males only) then known. Since then two more species have been described, i.e. A. pseudotypica Hirayama, 1984 and
A. inermis Appadoo and Myers, 2004. With the combination of characters of a not very setose Gn2, and the absence of special processes on basis and/or carpus of Gn1, the present species keys out to A. kergueleni Stebbing, 1888 from Kerguelen. It differs, however, from A. kergueleni in many characters, such as a longer and more slender merus, and a broader carpus and propodus on Gn1, and the virtual absence of an interramal spine of U2. In the form of the gnathopods A. karibu is somewhat more similar to A. maculata (Thomson, 1879) from Australia and New Zealand, but that species has heavily setose antennae.

Of the more recently described species, A. pseudotypica from Japan has a very different Gn1, with a very elongate carpus and propodus, without a clear palm, and a very long dactylus. In A. inermis from Mauritius the merus of Gn1 is uncommonly short, and the palm of the propodus much more oblique.

This is the first time that an Aora species has been found as a possible associate of majid crabs, although this single specimen of course does not prove the association. Earlier, an as yet unidentified Aora has been found on hermit crabs off New South Wales, Australia (W. Vader, unpublished data), while A. hebes Myers and Moore, 1983 seems to be an associate of sponges.

Family EUSIRIDAE s.l.
Paramoera falklandica n. sp.
(Figures 10–12)

Type material
Holotype: ovigerous female 9 mm, in alcohol. East Falkland, Choiseul Sound, 30 m, from Paralomis granulosa and Eurypodius latreillei, caught in baited traps, 29 October 2003, A. and W. Vader leg. Deposited at Tromsø Museum no. 13846. Paratypes: one male 9 mm, 16 smaller specimens in alcohol, two slides ovigerous female and two slides male, same locality. Deposited at Tromsø Museum no. 13847.

Additional material
Seven specimens, Lively Sound, E. Falklands, March 2003, A. Vader, from Paralomis; 61 specimens, Lively Sound, East Falkland, 15 April 2003, A. Vader, from Paralomis bins; 11 specimens, Lively Sound, East Falkland, 3 May 2003, A. Vader, from “spider crabs”, a few from bins; 292 specimens, Choiseul Sound, East Falkland, 29 October 2003, A. and W. Vader, from crab bins; 15 specimens, Choiseul Sound, East Falkland, 29 October 2003, A. and W. Vader, from Paralomis granulosa.

Type locality
Choiseul Sound, East Falkland, from Paralomis.

Diagnosis
A slender and colourful Paramoera species, with the almost unique combination of a small posterodistal tooth on epimeral plate 3, and a telson with only distal setae.
Figure 10. *Paramoera falklandica* n. sp.: Hd=head + A=antenna 1, 2 (×4); A1 detail (×10); UL=upper lip (×10). Md=mandible (×20); detail (×40); Mxp=maxilliped (×20); Mx=maxilla 1 (×20, ×40); Mx2, LL=lower lip (×40).
Figure 11. *Paramoera falklandica* n. sp.: Gn1=gnathopod 1, Gn2 twisted, Gn2 ordinary female (×4); below Gn1, 2 detail (×10); Gn1, 2, male (×10).
Figure 12. \textit{Paramoera falklandica} n. sp.: P=peraeopod 3, 4, 5, 6, 7; Ep=epimeral plate 1–3 female ($\times$ 4); U=uropod 1, 2, 3, T=telson female ($\times$ 10); T detail sketch; U3 male ($\times$ 10).
Description

Male and ovigerous female both 9 mm. Body: dorsally smooth. Head: rostrum very short, lateral cephalic lobe blunt; eyes large, rounded with many well-developed ommatidia. Epimeral plates 2–3 with small posterodistal tooth.

Antennae: A1>A2. A1 long, flagellum with 35 articles; peduncle much shorter than flagellum, with article 1>2>3, sparsely setose; accessory flagellum tiny, one-articulate. A2 also long, flagellum with 45 very short articles; peduncle articles 4 and 5 subequal, sparsely setose.

Mouthparts: labrum rounded. Mandible with incisor process strong, accessory processes well developed, lacinia mobilis trifurcate; molar trituritative, strong, surrounded with stiff setae; palp strong, three-articulate, with article 3 subequal to 2, rounded, with a fringe of equal-sized comb-shaped D-setae and longer distal E-setae. Maxilla 1 inner plate with four stout pappose setae, outer plate with 9–11 pectinate spines; palp two-articulate, article 2 rounded, with a “crown” of seven short and five long robust setae and two longer marginal setae. Maxilla 2 inner plate with oblique row of six long plumose setae medially and simple shorter setae distally, outer plate with rows of plumose and simple setae. Labium: inner lobes present, small. Maxilliped: inner plate reaching but not surpassing article 1 of palp, outer plate reaching end of article 2 of palp; palp with four articles, outer margin scarcely setose, inner one with regular simple setae; article 1 outer margin distally scarcely lengthened, article 1 twice as long as article 2, article 3 distally lobed, with group of long and short setae; dactylus smooth, insertion subdistally on article 3, surpassed by lobe.

Gnathopods: alike, but sexually diverse, medium, Gn2 longer than Gn1. Gn1 female: coxa anterodistally slightly expanded, distal margin vaguely crenulate, with minute posterodistal tooth in male; ratio coxa: propodus=2; basis long, narrow, with groups of short setae; carpus almost as long as propodus, with two large groups of setae on hind margin; propodus narrow, with parallel sides and groups of setae on hind margin, ratio length: breadth is 2.25; palm almost transverse, somewhat convex, almost smooth but palmar angle with two robust setae; dactyl as long as palm, smooth. Gn1 male: carpus and propodus much stronger, ratio coxa: propodus=1.2; propodus clearly longer than carpus. Gn2 in both sexes similar to Gn1, but almost twice as large. Gn2 female propodus twice as long as propodus Gn1; coxa with parallel margins, anterior margin slightly rounded; basis long, with short setae on posterior margin; carpus triangular, longer than broad; propodus clearly much larger than carpus, with parallel sides and five to seven groups of setae on hind margin. Palm almost transverse, slightly convex, almost smooth but row of fine setae subdistally, palmar angle with a group of three robust setae. In females, where the body is much more depressed than in males, both gnathopods are more and more twisted with age, so that the propodus is held not vertically, but parallel to the body, with its surface carried horizontally. Gn2 male propodus about twice as long as Gn1, similar to female.

Peraeopods: P3 coxa as in Gn2, basis narrow, merus as long as carpus, almost unexpanded distally, ratio propodus: carpus=1.5, propodus unexpanded distally; dactylus strong, falcate. P4: coxa broad, longer than broad, as deep as coxa 2–3, with shallow posterior emargination; basis and merus narrow, merus with slight distal lobe; propodus longer than carpus. P5–7: basically similar, same size as P3–4; coxae short; basis broadly expanded, with posterior expansions smooth, merus distally somewhat lengthened, propodus > carpus, ratio=1.5–1.6; dactylus strong, falcate. In P7 distal robust setae on propodus give a hint of “subchelate pereopod”.

Crab-associated amphipods from the Falkland Islands 3095
Uropods: U1 slender, peduncle longer than rami; peduncle with three to seven marginal and two distal robust setae, rami with four lateral plus a group of distal robust setae; outer ramus slightly shorter than inner. U2: slender, with peduncle shorter than rami; outer ramus ca half the length of inner; peduncle with two marginal robust setae, inner (longer) ramus with four to five robust setae on both margins, outer ramus with two to three, both rami with group of distal robust setae. Ratio U2:U3 = 1.2; U3 peduncle short, naked, with a distal lobe; rami with marginal spines on both margins, outer ramus ca 80% of inner.

Telson short, cleft ca for half its length. Apices of distal lobes incised and bifurcate, with a short seta in the indentation, telson otherwise naked.

Gills on P2–7, oostegites on P2–5.

Colour in life. Very colourful and individually variable, with different types of chromatophores: scattered fields of superficial black ones and much denser fields of white ones. In addition there is a more diffuse red pigment, that in some specimens completely dominated, while in others it was largely absent. The eyes were red with a white “coating”. As an example one specimen had chalk-white fields of chromatophores on the peduncles of A1–2, laterally on the metasome segments, and dorsally on the head, mesosome segments 4, 5–6 (a large patch) and 7, with smaller white patches distally on the metasome segments. In addition, as was the case in many specimens, the bases of P5–7 were all-white, with smaller patches on merus and ischium, while the distal articles were almost colourless. But, as said, every specimen had a somewhat different colour pattern; furthermore the chromatophores are probably able to contract and expand in fresh animals.

Etymology

The adjective “falklandica” is chosen on account of the locality of the collection.

Discussion

“The identity of various species of Paramoera is so confounded presently that I cannot properly evaluate variables within that genus”, wrote Barnard in 1972, and Thurston (1974) who, at the same time as Bellan-Santini and Ledoyer (1974), made valiant efforts to create some order, added: “The taxonomy and distribution of species of Paramoera in Antarctic and sub-Antarctic regions has been complicated by the number of species involved, the lack of adequate descriptions of many of them and the sweeping synonymies assumed for several of the poorly known species described in the nineteenth century.” Barnard and Karaman (1991) recognized 39 described species plus some 10–15 evidently misidentified entities. In this paper we have primarily compared our material with the ca 27 species described from southern waters (for the authors’ names see Barnard and Karaman 1991, p 332).

In the initial sorting we used two main criteria, the form of the third epimeral plate and the presence or absence of lateral setae on the telson.

The third epimeral plate comes in two quite clearly separated different forms in Paramoera. Many species have a rounded epimeral plate, usually with a more or less clearly serrulated posterior margin: P. australis, P. austrina auct., P. brachyurus, P. chevreuxi, P. hamiltoni, P. hermitensis, P. hurleyi, P. pfefferi, P. rangitiva, P. schellenbergi, P. tristanensis, and “P. fissicauda” (sensu Bellan-Santini and Ledoyer 1974)—we were unable to establish the form in P. macquariae and P. willisi. Paramoera husvikensis has a “broadly angular” Ep3, but
all the other species: *P. assimilis*, *P. capensis*, *P. edouardi*, *P. fasciculata*, *P. gregaria*, *P. kergueleni*, *P. obliquimanus*, *P. parva* and *P. stephensi* have, just as the present material, a third epimeral plate with a small posterodistal tooth.

A few of these species have special features that make it clear that they are specifically different from the Falkland specimens: *P. obliquimanus* and *P. parva* have very characteristically formed gnathopods, as in a slightly different way have *P. fasciculata* and *P. rangitiva*. *Paramoera brachyurus* and *P. stephensi* (originally also described as *P. brachyura*) have a strangely shortened uropod 2, and *P. bidentata* has dorsal teeth.

The second criterion we used in sorting was the presence or absence of lateral setae on the telson. The following species have, as do the Falkland specimens, only distal setae: *Paramoera assimilis*, *P. australis*, *P. hermitensis*, *P. pfefferi*, and *P. tristanensis*; *P. hamiltoni*, *P. hurleyi*, and *P. rangitiva* have only very small setules laterally, so are close to this character state. All these species, except *P. assimilis*, have a rounded Ep3, and it is therefore only *P. assimilis* (Stebbing, 1888) that has the same combination of toothed Ep3 and a telson with distal setae only. *Paramoera assimilis*, found as a single specimen off the coast of South Africa, differs from *P. falklandica* in the configuration of the peduncle of A1 and the much stronger, though also uniarticulate, accessory flagellum. A number of *Paramoera* species have been reported from the Falkland Islands, generally from shore-collecting (Schellenberg 1931; Barnard 1932); somewhat unexpectedly, none of them is identical to the present material of a species, that apparently lives in large numbers at 20–40 m in Choiseul Sound. As we had no opportunity to carry out general collecting in the area, it is uncertain whether the present species really is an obligate associate of large decapods. Most *Paramoera* species seem to be generalists, occupying shore habitats in the cold Antarctic waters seasonally, and in more temperate waters year-round: a few have been collected subtidally. There are no earlier records of symbiotic associations.

**A survey of amphipod associations involving lithodid crabs**

We take the opportunity to review all known associations of amphipods with Lithodidae (Tables I, II). These fall into two groups: (1) lithodids from shallow water in cold-temperate boreal and antiboreal seas, and (2) deep-water lithodids from warm-water seas in California and Namibia. The two groups seem quite different: on the cold-water lithodids most associates belong to the “tube-living amphipods”, the photids and ischyrocerids (even though in reality no tubes are usually found); they seem to move freely over their host, and may in many cases, at least in ischyrocerids, be micropredators of the eggs of the host.

| Lithodid species         | Locality           | Depth (m) | Amphipod family | Amphipod species                  | Reference          |
|--------------------------|--------------------|-----------|-----------------|-----------------------------------|--------------------|
| *Paralithodes campschatica* | Alaska             | Not noted | Ischyroceridae  | *Ischyrocerus cf.* commensalis    | Kuris et al. 1991  |
| *Paralithodes campschatica* | North Norway       | 40–100    | Ischyroceridae  | *Ischyrocerus* commensalis        | Vader et al. forthcoming |
| *Paralomis granulosa*     | Falkland Islands   | 20–30     | Photidae        | *Gammaropsis* monodi              | This paper         |
| *Paralomis granulosa*     | Falkland Islands   | 20–30     | Ischyroceridae  | *Jassa kjetilanna* n. sp.         | This paper         |
| *Paralomis granulosa*     | Falkland Islands   | 20–30     | Eusiridae       | *Paramoera falklandica* n. sp.    | This paper         |
(Kuris et al. 1991). It is at present unknown whether the very basic photids in the genus *Gammaropsis* s.l. are also egg-predators or just harmless deposit feeders. The amphipods on the deep-water lithodids, on the other hand, appear to be obligate symbionts, often with elaborate clinging arrangements, and they belong to quite different families, the Caprellidae and Pleustidae (Takeuchi et al. 1989; Pretus and Abello 1993; Cadien and Martin 1999). In both groups of lithodid associates some of the amphipods concerned have also been found on majid crabs (Vader forthcoming).

As is evident from the present result of a single day’s collecting in the Falklands, our knowledge of the associate amphipod fauna of lithodid “crabs” is as yet only fragmentary.

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