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DESCRIPTION OF *ODONTOZONA ADDAIA* SPEC. NOV. (CRUSTACEA: DECAPODA: STENOPODIDAE) FROM A MARINE CAVE IN THE ISLAND OF MINORCA, WESTERN MEDITERRANEAN

by

J.LI. PRETUS

Pretus, J. Ll.: Description of *Odontozona addaia* spec. nov. (Crustacea: Decapoda: Stenopodidae) from a marine cave in the island of Minorca.

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Key words: Crustacea; Stenopodidae; *Odontozona*; new species; description; marine cave; Mediterranean; Balearic Islands; Minorca.

Odontozona addaia, a new species of stenopodid shrimp is described from a marine cave in the island of Minorca (Balearic Islands), being the first record of the genus for the western Mediterranean. One male and one ovigerous female were found during a systematic propspection of several Balearic caves during 1988. Sexual dimorphism is observed and described; the differences mainly concern a more developed third pereiopod in the male, and a distinct shape and armature of the pleonites and pleopods in both sexes. The distinction of this new taxon from the other known closely related species, *O. minoica*, is discussed.

J.Ll. Pretus, Department of Ecology, Faculty of Biology, University of Barcelona, Avda. Diagonal 645, E-08028 Barcelona, Spain.

Odontozona addaia spec. nov.
(figs. 1-6)

Material. — NE coast of Minorca, Balearic Islands, Spain, 40°01'57"N 4°11'46"E, littoral marine cave near Port Addaia Bay, 2 July 1988, ovigerous ♀, RMHN 37748 leg. J.Ll. Pretus & F. Orfila. Holotype ♂, RMNH D 37749; paratype.

Diagnosis. — Colour of fresh specimens red. Carapace with different cervical and postcervical grooves and rows of spines directed forward. The cervical groove is bordered by 15 well developed spines. The postcervical groove bears six dorsal spines, and a row of 15 lateral spines on each side. Rostrum with dorsal, ventral and lateral spines. Pleon with first three segments bearing

transversal carinae. Dorsal parts of pleon unarmed and smooth, without grooves. Anterior margin of first pleonite incised laterally. Midpart of pleura of segments 2-4 bearing one or two spines. Pleura with marginal spines. Eye cornea pigmented. Scaphocerite without dorsal spines. Appendages slender. The third pereiopod the largest. Pereiopods 4 and 5 with carpus and propodus segmented; propodus with 19 movable spines on pereiopod 4 and 27 on pereiopod 5, the dactyl are biunguiculate. Uropods elongate.

Description of ♂ holotype (total body length 23.6 mm). — Rostrum (fig. 2a) slender, widened ventrally, and reaching sligthly further than half the scaphocerite. Distal part curved upward. The dorsal margin carries six spines, of which one preorbital. Distal third of rostrum unarmed dorsally. Lateral margins with three spines in the center, and a couple of little spinules near the tip. Three spines emerge ventrally at the level where the dorsal row ends.

Carapace (fig. 2a) with a conspicuous cervical groove with its posterior margin bearing a cincture of 15 spines directed forward. Postcervical groove slightly developed, with six spines of the same length as the spines of the cervical groove. More laterally situated are 15 smaller spines on either side. Posterior margin of carapace with a cincture bearing 18 irregularly implanted spines. Two pairs of spines are placed laterally between cervical and postcervical grooves. Four spines on each side of the carapace are placed in front of the cervical groove. On the anterior part an oblique lateral row of ten spines and nine additional lateroventral spines are present. One antennal and branchiostegal, and two pterygostomian spines are present. Ventrolateral angles with three anterior spinules. Ventral margin setose from middle to posterior part, but not reaching the posteroventral angle.

Abdomen (figs. 3a, b) bent at level of third somite. Abdominal segments dorsally unarmed. First five sternites with a strong hooked spine medially. Those of sternites 1-3 directed anteriorly, on sternites 4 and 5 directed posteriorly. The first abdominal segment has a transverse dorsal carina in the posterior half, directed forward laterally, reaching the ventral pleural margin. Dorsally it is provided with a row of short setae. Anterior half of the segment incised at the level of the pleural basis. Pleuron non-spinose, ending in two processes, the anterior one bilobed. Second abdominal segment with an anterior transverse carina dorsal ending at the base of the pleura. Posterior half of this somite is smooth. Medially the pleuron bears two spines directed downward, situated in a short and completely smooth transversal groove. Pleural margin rounded, setose and with three little spiny protuberances; one anterior and two posterior. Third segment is longest and broadly produced posteromedially. A transverse carina on the anterior part of the segment is present. It is well developed dorsally and laterally, but interrupted in between, where it is

connected posteriorly with a completely smooth, oblique groove bearing two spines. Pleural margins setose, rather truncate, with three posterior spines and one anterior spine. Fourth segment without carina. Pleuron posteriorly incised, directed backward. One medial spine is present. Four marginal spines are present. Fifth segment with small pleuron directed posteriorly, provided with a long spiny protuberance. Tergal surface smooth. Sixth somite with two lateral spines. Small triangular pleuron, ending in acute protuberance connected ventrally with two oblique carinae with 14 long setae. Two oblique rows of ten triangular, posteriorly directed spines are present on the posterodorsal part. Posterolateral margins with a broad rounded lobe.

Telson (fig. 3b) lance-shaped, 1.8 times as long as the sixth abdominal segment, and 2.8 times as long as its maximum width; proximally narrowed between the widest part and the basal joint. A mediodorsal groove is flanked by two longitudinal carinae provided each with six strong, rather asymmetrically situated, posteriorly directed spines. Long setae are implanted at the basis of the spines. Medially there are another two pairs of spines, one pair proximally, the other pair at about the same level as the second pair of spines on the longitudinal carinae. Lateral margin distinctly separated from longitudinal carina by a wide groove. A pair of strong lateral, posteriorly directed spines is situated at ca. 1/3 of the telson length. Plumose setae are present on the lateral margins from just proximal of the lateral pair of spines to the distal end of the telson. Posterior margin with one medial spine, flanked by the last two spines on the dorsal carinae.

Cornea and eyestalk of the same length (fig. 2.d). Eyestalk with four dorsal spines, and two anterio-medial spines reaching the cornea. The antennular peduncle (fig. 2b) has a stout basal segment, which is distinctly longer than the second and third segment. Stylocerite well developed, elongate, five times as long as wide. Flagellum of antennula about 4.5 mm long. Flagellum of antenna 60 mm long. Scaphocerite (fig. 2e) with outer margin straight, bearing eight teeth on its distal two-thirds, and a ninth larger tooth at the tip. Inner margin convex, setose. Upper surface without spinules.

Mandibles (fig. 4a) elongate but stout. Molar and incisor process partially separate. Molar surface without distinct teeth. Incisor process asymmetrical. Right mandible with seven teeth. Left mandible with three teeth and additionally three smaller ones laterally. Mandibular palp (fig. 4b) strong; basal segment without setae. Second segment with lateral and distal setae. Distal segment broad, with numerous, long setae.

First maxilla (fig. 4c,d) with unsegmented palp, bearing sparce setae. Upper lacinia with curved parallel margins; distal end truncate and strongly armed with two or three rows of dentated spines. Inner margin with two setae. Outer

margin densely setose. Lower lacinia oval, with one margin slightly concave. Margins setose.

Second maxilla (fig. 4e) with a broad scaphognathite, ending in a triangular posterior part. Endopodite thin, not exceeding the anterior margin of the scaphognathite. Outer margin with three proximal setae. Inner margin and distal part provided with several setae. Endite with four lobes, all with distal setae. Proximal lobe of coxal endite with marginal setae, median part setose, distal lobe slender, elongate.

First maxilliped (fig. 4f) with a three-segmented endopodite. Proximal and central segments bear long setae laterally; the proximal segment also has long setae mesially. Exopodite long and slender, with distal setae. Basipodite with a straight and plumose inner margin. Coxopodite bilobed with a narrow peduncle. Epipodite bilobed.

Second maxilliped (fig. 4g) with a 7-segmented endopodite. Dactylus with distal spiny setae. Propodus and dactylus densely setose, the first longer than the second. Carpus triangular. Merus cylindric, more than twice as long as wide. Ischium and basis fused, and suture still distinct. Exopodite distally setose. Podobranch and epipodite present.

Third maxilliped (fig. 4h) strongly developed, 7-segmented endopodite reaching the end of the rostrum. Coxa with a small epipod and podobranch. External distal part of coxa with an acute, short tooth. Exopodite unsegmented. Basis very short. Ischium somewhat shorter than merus, with seven spines on the inner margin; outer margin without spines. Merus with three long, stout spines on the outer margin, one small distal spine, and an oblique row of eight lateral spines; the inner margin setose. Carpus with three small spines. Propodus with a setigerous organ at the inner distal part. Dactylus unarmed, slightly longer than the propodus and the carpus, latter two having the same length. Setigerous organ of dactylus reduced to a row of setae.

First pereiopod (fig. 5a) very slender and unarmed. Basis short, with two setae. Ischium shorter than merus, with simple setae. Merus and carpus thin and elongate, with few setae only. Carpus 1.25 times as long as the merus. Propodus and merus of equal length. Fixed finger as long as the palm. Both propodus and carpus with setigerous organ near the junction of the two articles. Fingers ending in hooked tips, with distal tufts of setae. Cutting edges with teeth.

Second pereiopod (fig. 5b,c) slender, longer than first and without setigerous organ. Fingers of chela hooked, with distal tufts of setae. Cutting edge entire, except for a broad, sharp, proximal, triangular tooth on both fingers, more developed on the propodus than on the dactylus. Length ratio of basis, ischium, merus and carpus as in first pereiopod. Chela shorter than carpus.

Third pereiopod (fig. 5d) longest and strongest of pereiopods. Ischium with one distal spine. Merus 2.5 times as long as the ischium, with eight ventral spines, three spines on inner lateral surface and three dorsal spines. Carpus a little shorter than merus, proximally narrow and widening in the distal half, carrying eleven dorsal spines, four ventral spines and a small distal spine. Propodus of the same length as the ischium and the merus, with nine dorsal spines, and with one ventral spine. Fingers shorter than palm. The dactylus has a broad ventral triangular tooth in the proximal third, which is directed backward, fitted between two teeth of the fixed finger. Fingers dorsally unarmed, with tips acutely hooked and crossing, distally bearing several single setae and tufts of setae. Cutting edge of dactylus with the teeth regularly spaced in a lamella. Propodus with a chitinous ridge.

Fourth and fifth pereiopods (fig. 5e,f,g) similar, very slender, and with biunguiculate dactylus. Propodus divided into five distinct segments and bearing 19 movable spines on the fourth, and 27 on the fifth pereiopod, all directed distally. Carpus longest, divided into six or seven segments. It bears two marginal spines and a few setae. Merus and ischium almost without setae, undivided.

First pleopod (fig. 6a) uniramous; second to fifth (fig. 6b-e) biramous. Exopodite of first pleopod and basipodite equal in length. Both with plumose setae on the inner margin of the basis and on margins in the exopodite. Basis of pleopods 2 to 5 without setae. Basis of pleopods 2-4 with one posterior spine, pleopod 5 with two posterior spines. Rami fringed by plumose setae.

Basal segment of uropod (fig. 3c) with the posterior disto-dorsal angle produced into a large tooth. Exopodite wider than endopodite, twice as long as broad, its outer margin with seven teeth. Dorsal surface with two unarmed carinae. Endopodite three times as long as broad, with three teeth and long simple setae on outer margin. Dorsal surface with an inner ridge bearing five hairs. Unarmed margins of both articles with plumose setae. Margins of both endo- and exo-podite unarmed, with plumose setae.

Additional description of ♀ paratype (total body length 21.6 mm) (fig. 1). — Carapace as in ♂, but several rows with different number of spines: five dorsal rostral spines (six in ♂), 14 cervical spines (15 in ♂), 11 spines on each side of the postcervical medial spines (15 in ♂) and three spines between cervical and postcervical grooves (two in ♂). Rostrum with two lateral spines, which are distinctly smaller than those of ♂. Pleon similar to that of ♂; however, only one medial pleural spine is present on segment two, which is unarmed marginally. There is one medial spine present on the pleura of the fifth segment, which is lacking in ♂. The margins of the pleura are more rounded than in ♂, notably of segments 2 and 3. Sternites without medial spines. Telson like that

of ♂, but with two more dorsolateral spines one on each side of the basis, in line with the first two medio-dorsal spines.

Antennula with reduced stylocerite. Olfactory flagellum not distinctly separated from main flagellum. Mouthparts are not essentially different from those of ♂. Third pereiopod is shorter and more slender than in ♂, its total length 5.5 times length of carapace (6.0 times in ♂). Carpus 0.8 times length of propodus, 0.7 times in ♂. Carpus of both fourth and fifth pereiopod with seven segments. Propodus 5-segmented in the fourth, and 6-segmented in the fifth pereiopod.

The basis of the first four pleopods bordered by plumose setae, a feature absent in ♂. The basis of the second and third pleopods with an inner carina that gives it a triangular shape in transversal section. This carina bears a few long, stout, transversely placed and irregularly distributed setae, which probably contribute to egg mass adhesion. The basis of the fourth pleopod is expanded laterally in a semicircular setose carina bearing setae that are longer than normal plumose setae of pleopods. The basis of pleopod 4 and 5 bears two and three spines respectively on the posterior margin. Uropods with outer margin of endopodites and exopodites bearing four and eight spines respectively.

The number of eggs in collected ♀: 237. Eggs sligthly elongate in shape, up to 640 × 500 μm.

Branchial formula (♀):

	Maxillipeds			Pereiopods				
	I	II	III	I	II	III	IV	V
Pleurobranches	0	1	1	1	1	1	1	1
Arthrobranchs	0	1	2	2	2	2	2	0
Podobranchs	0	1	0	0	0	0	0	0
Epipods	1	1	1	1	1	1	1	0
Exopods	1	1	1	0	0	0	0	0

Habitat. — Littoral cave near Port Addaia (cf. Material). The cave entrance is located at a depth of 30 meters. Just after the entrance, a broad siphon leads to shallow, dark waters, reaching sea level. Both specimens were collected at 5 meters depth, at a temperature of 17°C. This homothermic region is placed over a thermocline that begins at 14 meters. Bottom water 22°C. A slight dilution of seawater by infiltrating epicontinental water allows thermal inversion, maintained by a fall to 20.5 g/l chloride content of upper waters (date as above). Together with *Odontozona addaia* were observed *Stenopus*

spinosus Risso and dense populations of the mysids *Hemimysis* spec. and *Siriella* spec. Cave fishes like *Oligopus ater Risso* inhabit the inner upper parts of the cave.

Etymology. — The specific epithet *addaia* is after Port Addaia Bay, the bay nearest to the type locality.

Sexual dimorphism. — Excluding several small differences mentioned in the description, probably of no sexually dimorphic value, a stouter third pereiopod in ♂ mainly concerning the chela, is significant. Ventral abdominal spines are lacking in ♀ on the pleon, which also has its pleura more rounded and less spinose laterally. The basis of pleopods 2 to 4 are typical in both ♀ and ♂. In ♀ an inner carina is present on pleopods 2 and 3, which has a semicircular expansion on pleopod 4. Long distinct setae, directed to the medial part of the abdomen, are implanted on these carinae. The basis of pleopods 2 to 4 is plumose in ♀, and glabrous in ♂. The shape of the exopodite of the first pleopod is also dimorphic (the ♂ exopodite is shorter than its basal width, while in ♀ it is longer and more narrow), as has been observed previously by Borradaile (Holthuis, 1946: 9) in *Stenopus hispidus*(Olivier).

Affinities. — *Odontozona addaia* spec. nov. is similar to other species like *O. minoica* Dounas & Koukouras, 1989, *O. libertae* Gore, 1981, or even *O. ensifera* (Dana, 1852), in having its pleonites non-sculptured and in the topology of the spine rows on the carapace. However, the presence of one or two well developed spines on the middle part of the pleura of the segments 2 to 4 (♂) or 2 to 5 (♀) clearly separates the new species from all three species mentioned before. Moreover, *O. addaia* differs from *O. ensifera* in having a lower number of dorsal spines on the rostrum, as well as in the postcervical and posterior rows of spines on the carapace. It differs also in having a different armature of the margins, and the third pereiopod, and by a higher number of movable spines in the third and fourth pereiopods. The new species differs from *O. libertae* mainly by the shape of its rostrum, the presence on the carapace of a row of ventrolateral spines and a different configuration of spines on its posterior margin. The number of segments of the carpus and propodus of the fourth and fifth pereiopods is eight and five or six respectively in *O. libertae*, while it is six or seven and five in the new species. In the pleon *O. addaia* differs from *O. libertae*, having a more acute posterior margin of the fifth pleura, a higher number of more elongate spines on the telson and the outer margins of both rami of the uropods. The new species has the closest similarity with *O. minoica*, recorded from a depth of 330 metres off the northwestern coast of Crete in the eastern Mediterranean (Dounas & Koukouras, 1989). The differences found in comparing ♀♀ of both species are summarized in Table 1. The presence of medial spines on the pleura 2 to 5 in ♀♀ of *O. addaia* is discrimi-

nating, *O. minoica* has small single spines on pleura 3 and 4 only. Other differences in the pleon concern the shape of the posterior margins of pleura 4 and 5, the former being incised, the latter more acute, and the presence of only very smooth and short pleural grooves in pleonites 2 to 4 of the new species.

Table 1. Main differences between the females of *O. addaia* spec. nov. and *O. minoica* Dounas & Koukouras, 1989.

	O. addaia	*O. minoica*
Rostrum, dorsal and ventral margins	tapering distally	parallel distally
Rostrum, dorsal spines	5 on posterior 2/3	7 regularly distributed
Rostrum, ventral spines	3	4
Spines on cervical groove	14	18
Grooves on pleura 2-4	indistinct	marked
Pleura 2, medial spines	1	–
Pleura 3, medial spines	2	1
Pleura 4, medial spines	1	1
Pleura 5, medial spines	1	–
Ratio cornea/eyestalk	1	< 1
Scaphocerite, marginal spines	10	11
Setigerous organ on dactylus of third maxilliped	reduced	present
Colour	red	transparent

Odontozona addaia is the first member of the genus found in cave waters, and the first record of the genus in the western Mediterranean. Up to now ten species of the genus have been described. They are represented in the Indo-Pacific region by *O. spongicola* (Alcock & Anderson, 1899), *O. ensifera* (Dana, 1852), *O. spinosissima* Kensley, 1981; in the eastern Pacific by *O. rubra* Wicksten, 1982; in the western Atlantic by *O. libertae* Gore, 1981, *O. striata* Goy, 1981; in the eastern Atlantic by *O. edwarsi* (Bouvier, 1908), and in the Mediterranean by *O. minoica* Dounas & Koukouras, 1989, and by the species described above.

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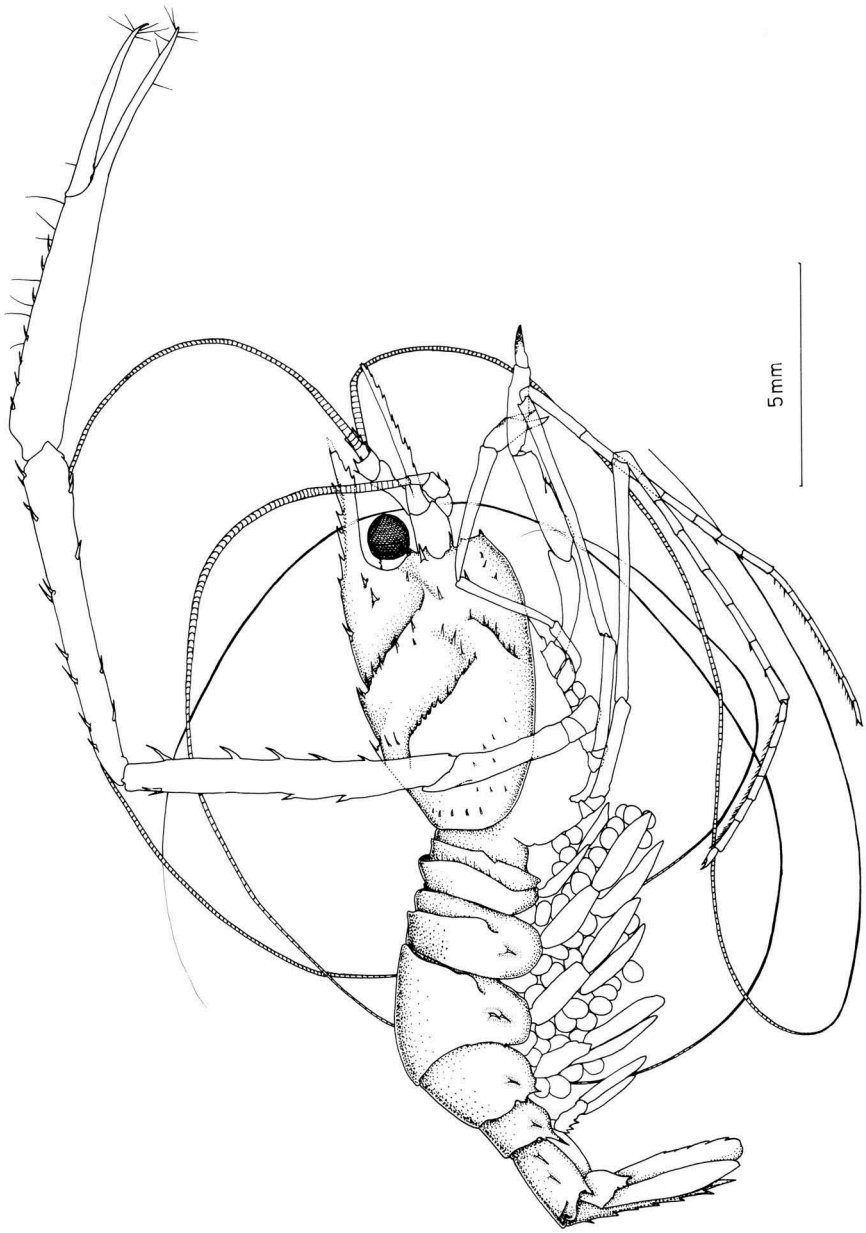

Fig. 1, *Odontozona addaia* spec. nov., ♀, paratype (RMNH D 37749), in lateral view.

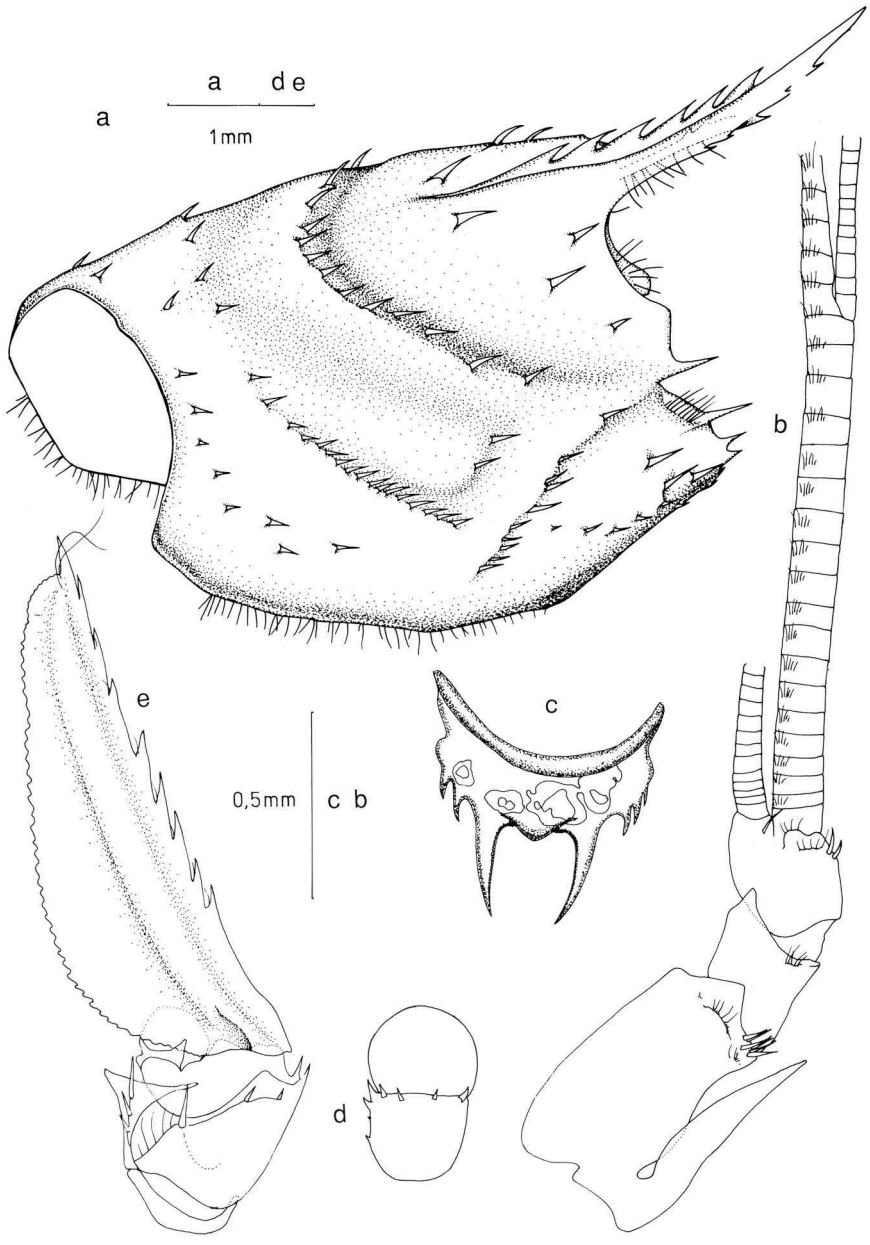

Fig. 2, *Odontozona addaia* spec. nov., ♂, holotype, (RMNH D 37748). a, carapace in dorsolateral view; b, basal part of first antenna; c, epistome; d, eye; e, scaphocerite (setae of inner margin not drawn).

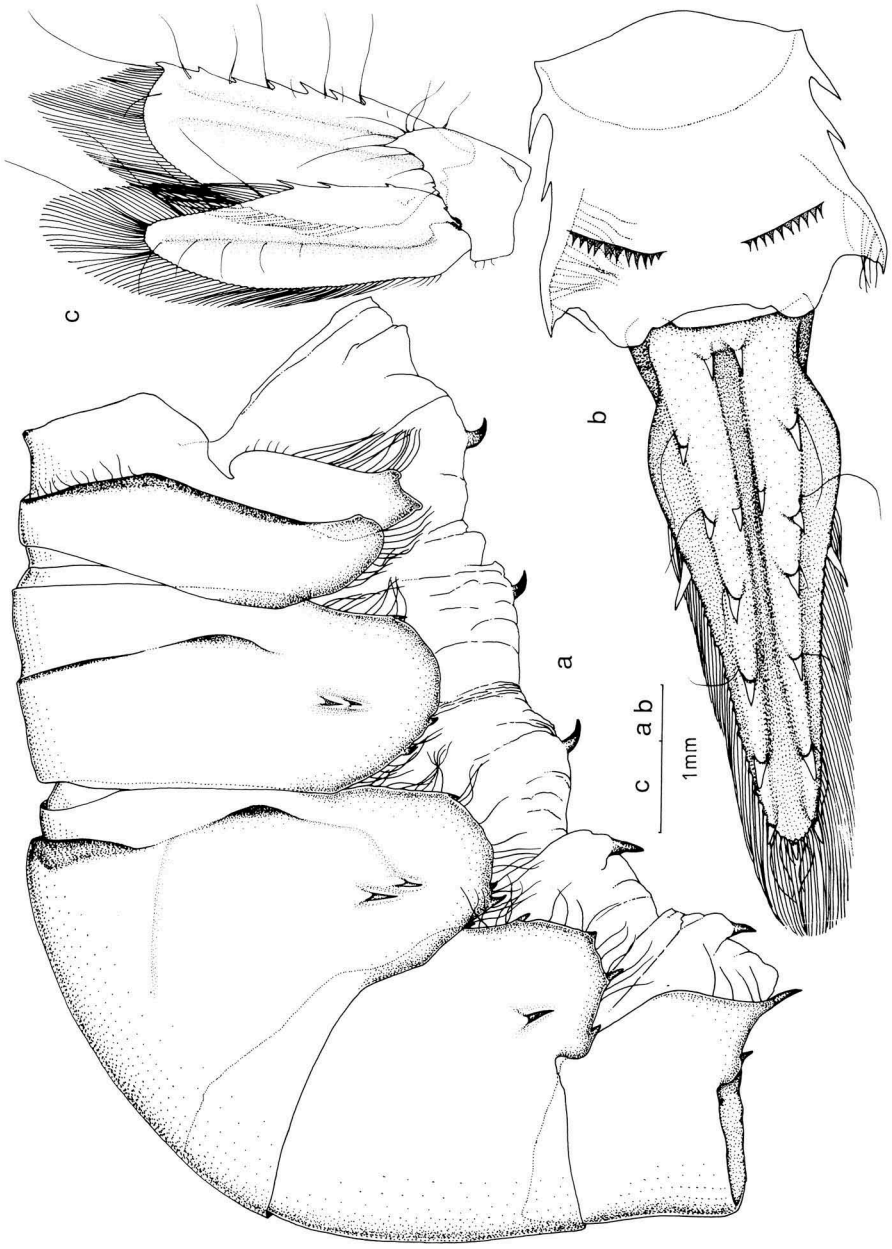

Fig. 3, *Odontozona addaia* spec. nov., ♂, holotype (RMNH D 37748). a, pleonites 1-5; b, pleonite 6 and telson in dorsal view; c, uropod.

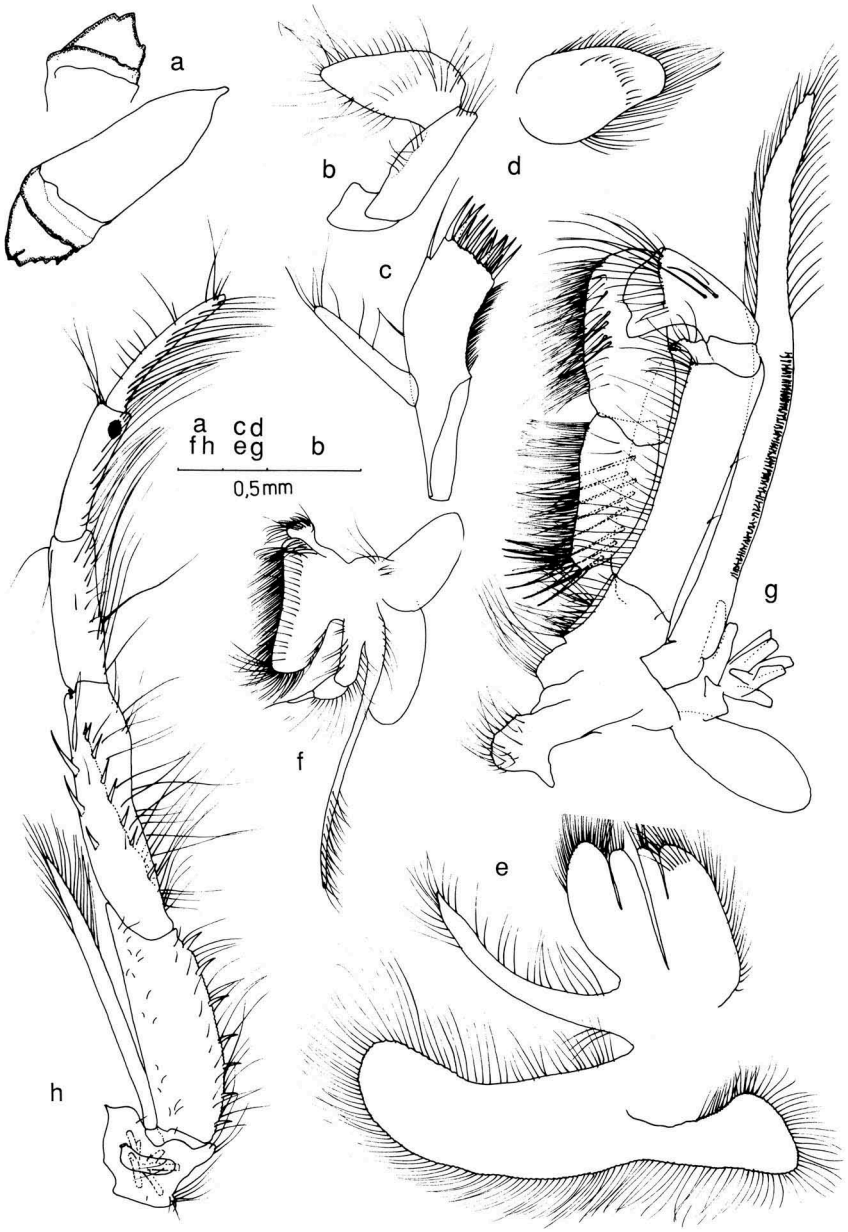

Fig. 4, *Odontozona addaia* spec. nov., ♂, holotype (RMNH D 37748). a, mandibles; b, mandibular palp; c, maxilla 1; d, inner lobe of maxilla 1; e, maxilla 2; f, maxilliped 1; g, maxilliped 2; h, maxilliped 3.

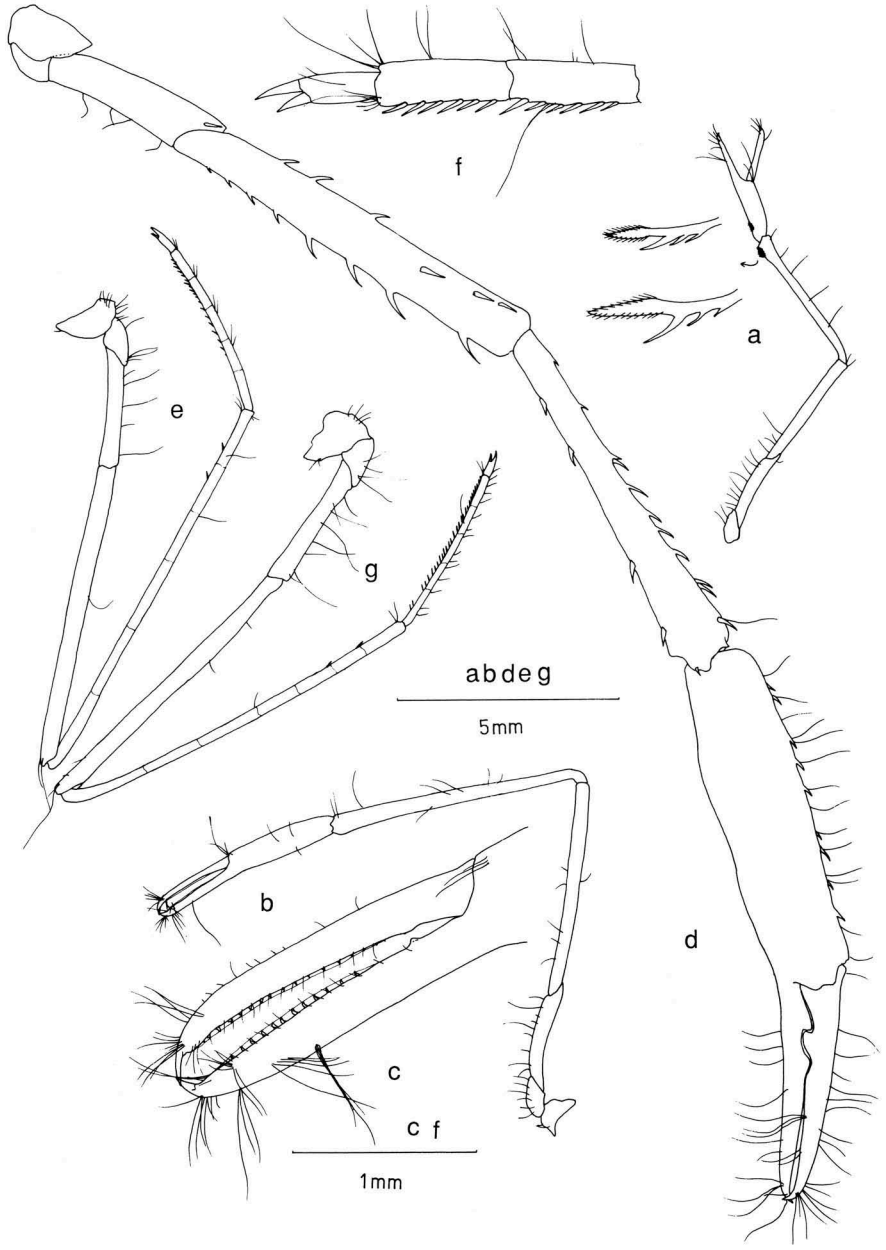

Fig. 5, *Odontozona addaia* spec. nov., ♂, holotype (RMNH D 37748). a, pereiopod 1, with detail of spines of the setigerous organ; b, pereiopod 2; c, distal end of pereiopod 2; d, pereiopod 3; e, pereiopod 4; f, distal end of pereiopod 4; g, pereiopod 5.

Fig. 6, *Odontozona addaia* spec. nov., ♂, holotype (RMNH D 37748) and ♀ paratype (RMNH D 37749). a, pleopod 1; b, pleopod 2; c, pleopod 3; d, pleopod 4; e, pleopod 5. Holotype, ♂ a_1-e_1; paratype, ♀: a_2-e_2. Normal plumose setae are not drawn except in pleopods 3 and 4 ♀. Special setae in basis ♀ pleopods distinctly marked (pleopods 2 and 3).