

***Atoportunus*, a remarkable new genus of cryptic swimming crab
(Crustacea; Decapoda; Brachyura: Portunidae), with descriptions of
two new species from the Indo-West Pacific**

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Abstract. – A new genus of chalicophilous and cavernicolous swimming crab (Portunidae), *Atoportunus*, and two new species, *A. gustavi* and *A. pluto*, are described from Guam, Japan, Hawaii and Christmas Island (Indian Ocean). This is the first such portunid known, and has all the features associated with an obligate cavernicolous lifestyle, viz. reduced coloration, elongated appendages and reduced eyes.

Introduction

Swimming crabs of the family Portunidae are among the most speciose marine crabs, and is represented by 44 recognised genera with some 320 species, the majority of which occur in the Indo-West Pacific. Yet, no obligate cavernicolous species with the associated morphological adaptations, has been reported thus far. We here report on a remarkable new genus of chalicophilous (rubble-dwelling) and cavernicolous portunid and two new species from Guam, Hawaii, Japan and Christmas Island.

The abbreviations G1 and G2 are used for the male first and second pleopods respectively. All measurements provided are of the carapace width and length respectively. The terminology used essentially follows that used by Wee & Ng (1995). Specimens are deposited in the Florida Museum of Natural History, University of Florida (UF); Western Australian Museum (WAM), Perth, Australia; National Science Museum, Tokyo (NSMT); and Zoological Reference Collection (ZRC), Raffles Museum of Biodiversity Research, National University of Singapore.

Taxonomy

Family Portunidae Rafinesque, 1815
Subfamily Portuninae Rafinesque, 1815
Atoportunus, new genus

Type species: *Atoportunus gustavi*, new species, by present designation.

Diagnosis: Carapace with regions poorly defined; pigmentation reduced. Front bilobed, each lobe with double-rimmed margin. Orbits very small, eyestalk reduced, cornea relatively small. Anterolateral margin with 7 prominent lobes or teeth (including external orbital lobe), all margins lined with sharp denticles or granules. Epibranchial ridge lined with granules, joins tip of last tooth; mesobranchial ridge with low granules. Basal antennal segment longitudinally rectangular, simple. Merus of third maxilliped with rounded antero-external angle. Chelipeds symmetrical, very slender, elongate; inner margin of merus with sharp spines; palm dorso-ventrally compressed, transversely ovate in cross-section; fingers styliform, tip strongly hooked, cutting edges with sharp spines. Ambulatory legs unarmed; propodus of last leg subfoliaceous; dactylus of last leg spatuliform, without ridges; dactyli of other legs styliform. Anterior thoracic sternum relatively wide; sternites 2 and 3 separated by faint suture; sternites 3 and 4 separated by very shallow groove; sternite 4 with deep longitudinal median groove. Male abdominal segments without any obvious transverse costae on segments. G1 C-shaped; distal part with numerous short spines and simple short setae; G2 ca. 0.8 times length of G1, furca-like.

Etymology: The name is derived from an arbitrary combination of the Greek word "atopos" for strange, and the genus name *Portunus*. The gender is masculine.

Remarks: *Atoportunus*, new genus, is so unusual that no appropriate comparisons with other portunid genera are really possible. We have assigned *Atoportunus* to Portuninae as it has a relatively simple basal antennal segment and a relatively large number of anterolateral teeth (cf. Apel & Spiridinov, 1998). Within this subfamily, its external appearance bears a superficial resemblance to *Portunus convexus* De Haan, 1833, although in the form of its G1, it is closer to *Portunus hastatoides* Fabricius, 1798. In its other aspects (notably in the form of its chelipeds), however, *Atoportunus* differs markedly from these two species of *Portunus*. The elongate chelae and fingers of *Atoportunus* is somewhat reminiscent of the condition in the American *Lupella* Rathbun, 1897 (type and only species *Cancer forceps* Fabricius, 1793) (see Rathbun 1930: 132, Pl. 57), but *Lupella* has proportionately much longer fingers (described as filiform by Rathbun 1930: 133), with the cutting edges lined with numerous teeth rather than long spines. Their carapace shapes are also very different, with *Lupella* having much longer lateral carapace spines.

The loss of pigmentation (both species recognised here are reddish-orange to pale orangish white), reduced orbits and eyes (the eyestalk is reduced and the

cornea is relatively small compared to portunids of equivalent sizes), and the very long and slender chelipeds and ambulatory legs of both *A. gustavi* and *A. pluto* are actually typical features of obligate cavernicoles (see Guinot 1988, 1994). *Atoportunus* is thus the first such portunid crab known. Almost all the specimens of *A. gustavi* were found in rubble beds while all material of *A. pluto* were from caves. Deep rubble beds are essentially similar habitats to marine caves, with no or little daylight and it is not at all surprising that *A. gustavi* occurs in both habitats. In any case, specimens of *A. gustavi* have been observed above the rubble beds during the night (see remarks for the species).

Atoportunus gustavi, new species
(Figs. 1A, B, 2-5)

Material examined: Holotype – male (16.1 by 8.8 mm) (UF 2091), Agat Bay, north of Alutom Island, fore-reef, in deep rubble, ca. 5 m, Guam, coll. H. T. Conley, 18 June 2000. Paratypes – 1 female (23.4 by 13.5 mm) (ZRC 2002.173), same location as holotype, coll. H. T. Conley, 14 June 2000; 1 juvenile male (6.0 by 3.8 mm) (UF 2092), Agat Bay, north of Alutom Island, fore-reef, in deep rubble, ca. 5 m, Guam, coll. H. T. Conley, 10 January 2001; 1 female (23.2 by 13.5 mm) (UF 2093), Apra Harbour, outer end of Glass Breakwaters, under silty rocks, 6-9 m, Guam, coll. H. T. Conley, 5 August 1998; 1 male (dismembered) (UF 2094), same location as holotype, 5 m, coll. H. T. Conley, 28 September, 2000; 1 male (17.4 by 9.9 mm) (ZRC 2000.680), Piti Lagoon, deep rubble, 6-9 m, Guam, coll. H. T. Conley, 8 August 1999; 1 male (19.7 by 11.3 mm) (ZRC 2002.177), Glass Breakwater, near harbour mouth, among rocks, ca. 3-8 m depth, coll. H. T. Conley, 22 July 2001. Others – 1 female (25.5 by 15.0 mm) (NSMT), 30 m, on calcareous muddy sand, in totally dark Sabachi Cave, Yonaguni Island, Yaeyama Group, Ryukyu Islands, Japan, coll. T. Kase & O. Ohashi, 25 September 1994; 1 female (28.2 by 16.6 mm) (WAM), cave, Christmas Island, Indian Ocean, coll. T. Kase.

Diagnosis: Anterolateral margin with first 2 teeth lobiform, next 5 teeth sharp, spine-tipped. Epibranchial ridge lined with row of numerous rounded granules; mesobranchial ridge lined with low granules. Merus of cheliped very slender, adult inner margin with 6 prominent spines; carpus very slender; cutting edge of dactylus with 2 spines; cutting edge of pollex with 5 spines. Merus, carpus and propodus of ambulatory legs very slender.

Description of holotype: Carapace distinctly broader than long; regions poorly defined with no sharp ridges or deep grooves; dorsal surface finely granular, with short scattered setae. Sub-orbital region lined with submedian transverse row of sharp granules, visible from dorsal view; pterygostomial region with transverse row of granules which leads to sub-branchial region. Front ridged, bilobed, with 2 low, triangular lobes with rounded tips, separated from each other by shallow cleft; ridge of lobes extending backwards, encircling a small transverse ovate area just behind margin of each lobe, area appearing

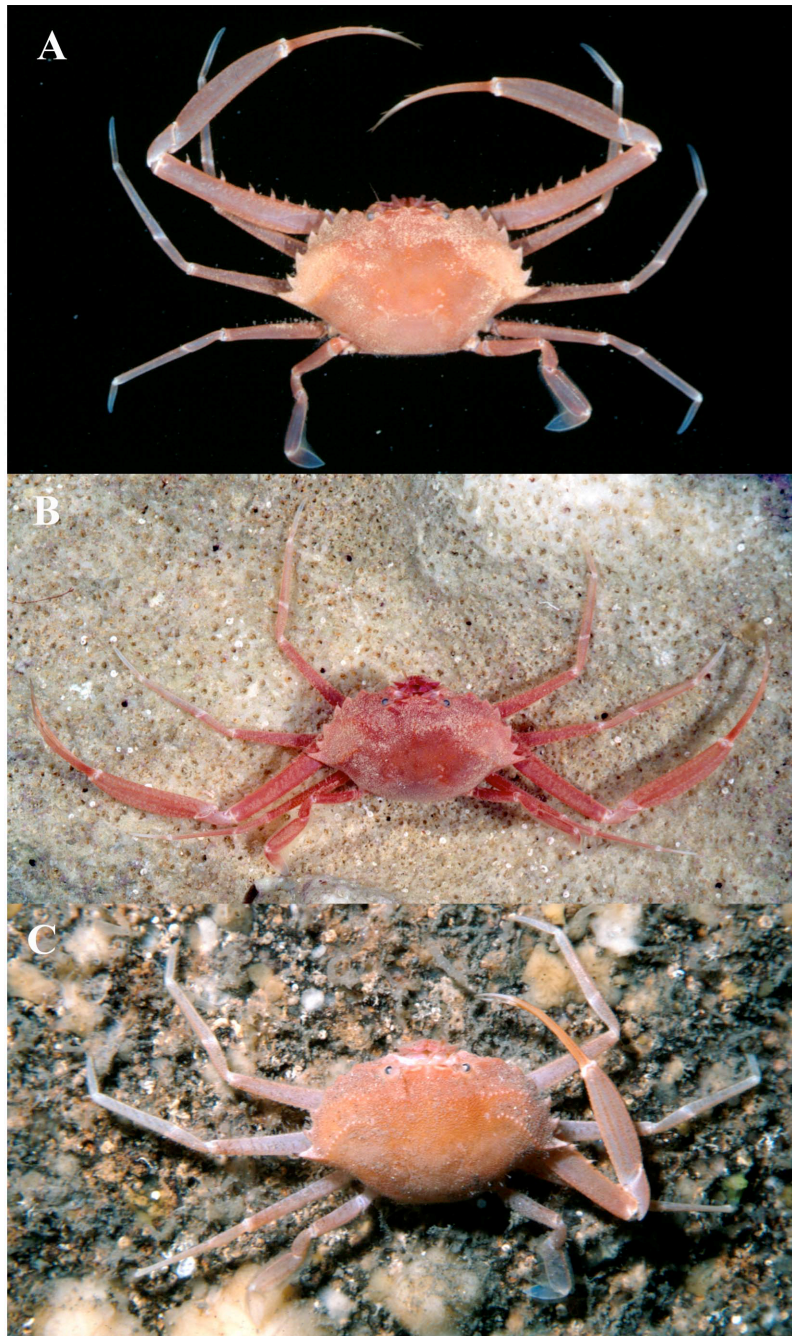


Figure 1. Colors in life. A, B, *Atoportunus gustavi*, new species, paratype male (17.4 by 9.9 mm) (ZRC 2000.680); C, *Atoportunus pluto*, new species, holotype female (23.5 by 12.9 mm) (UF 2095). (Photos: G. Paulay).

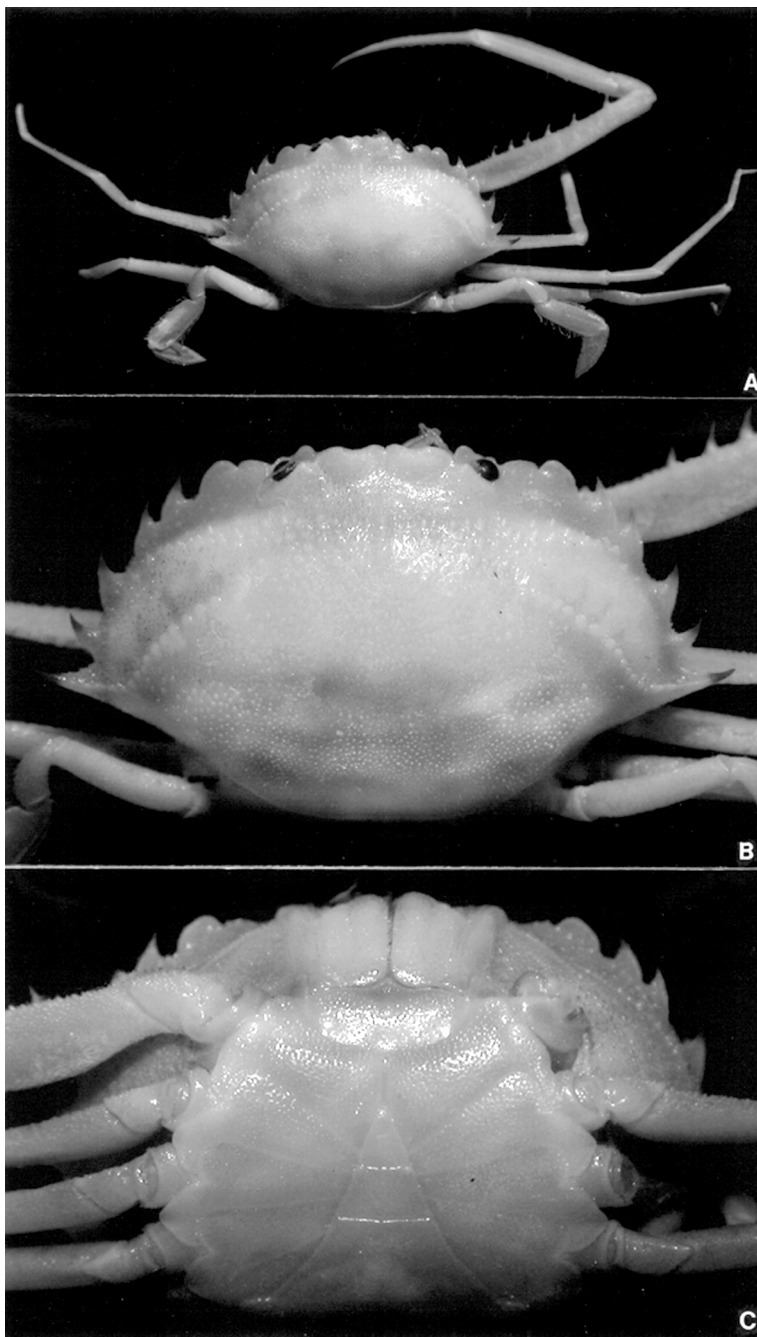


Figure 2. *Atoportunus gustavi*, new species. Holotype male (16.1 by 8.8 mm) (UF 2091). A, overall view; B, carapace; C, ventral view.

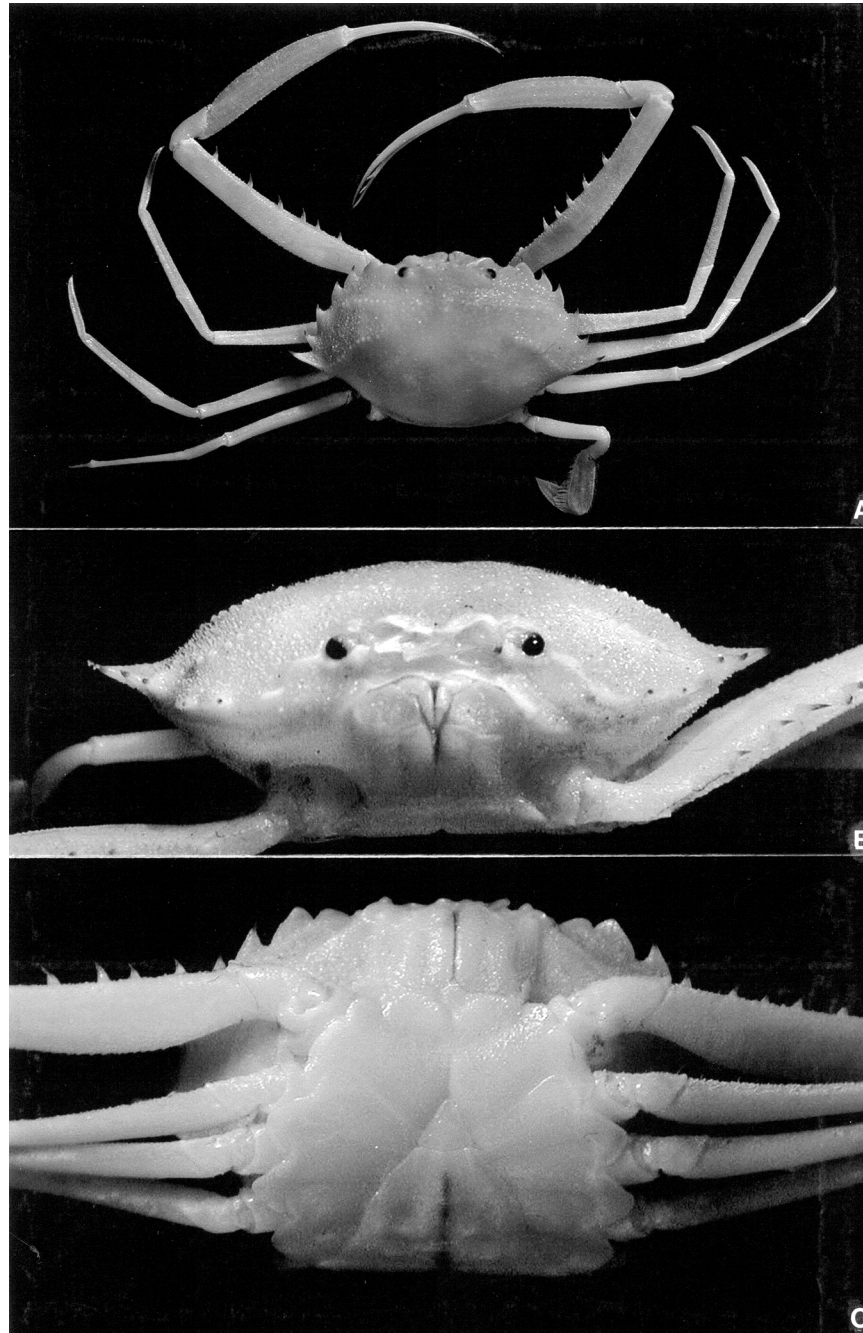


Figure 3. *Atoportunus gustavi*, new species. Paratype female (23.4 by 13.5 mm) (ZRC 2002.173).
A, overall view; B, frontal view; C, ventral view.

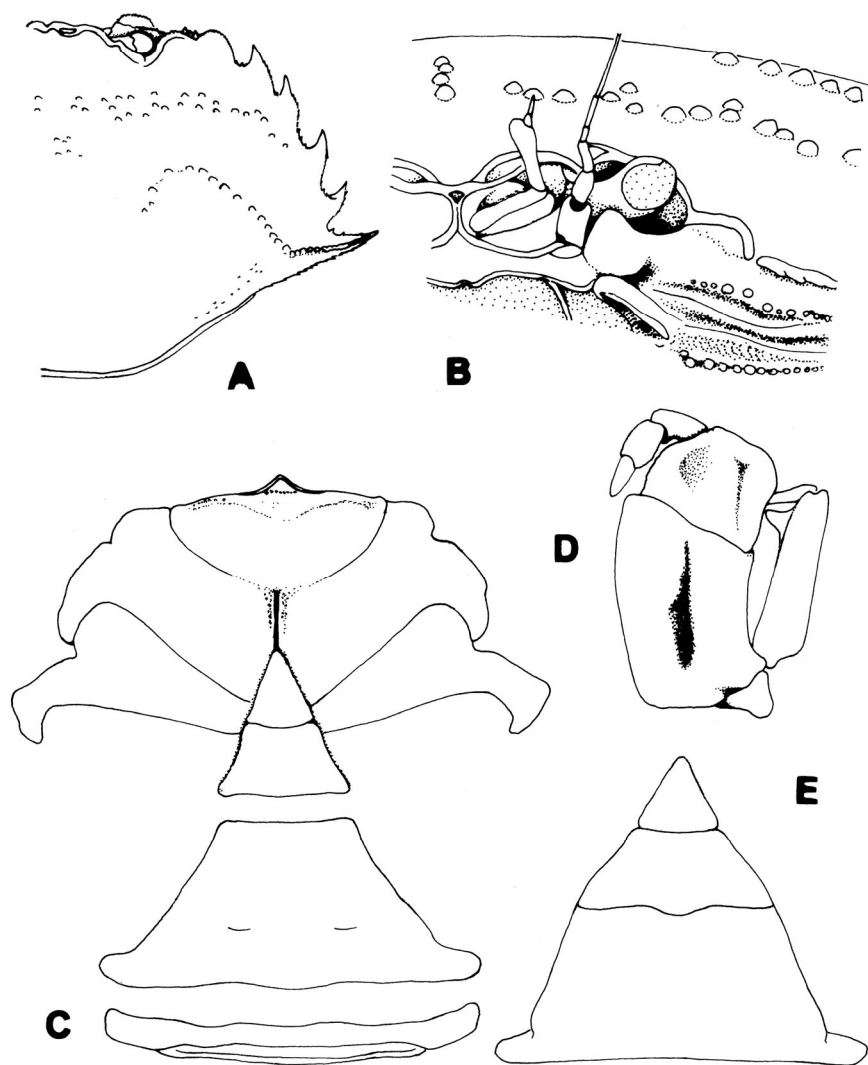


Figure 4. *Atoportunus gustavi*, new species. A-D, Holotype male (16.1 by 8.8 mm) (UF 2091); E, paratype female (23.4 by 13.5 mm) (ZRC). A, right side of carapace; B, front showing antennae and orbits; C, Anterior thoracic sternum and male abdomen; D, left third maxilliped; E, female abdominal segments 3-6 and telson.

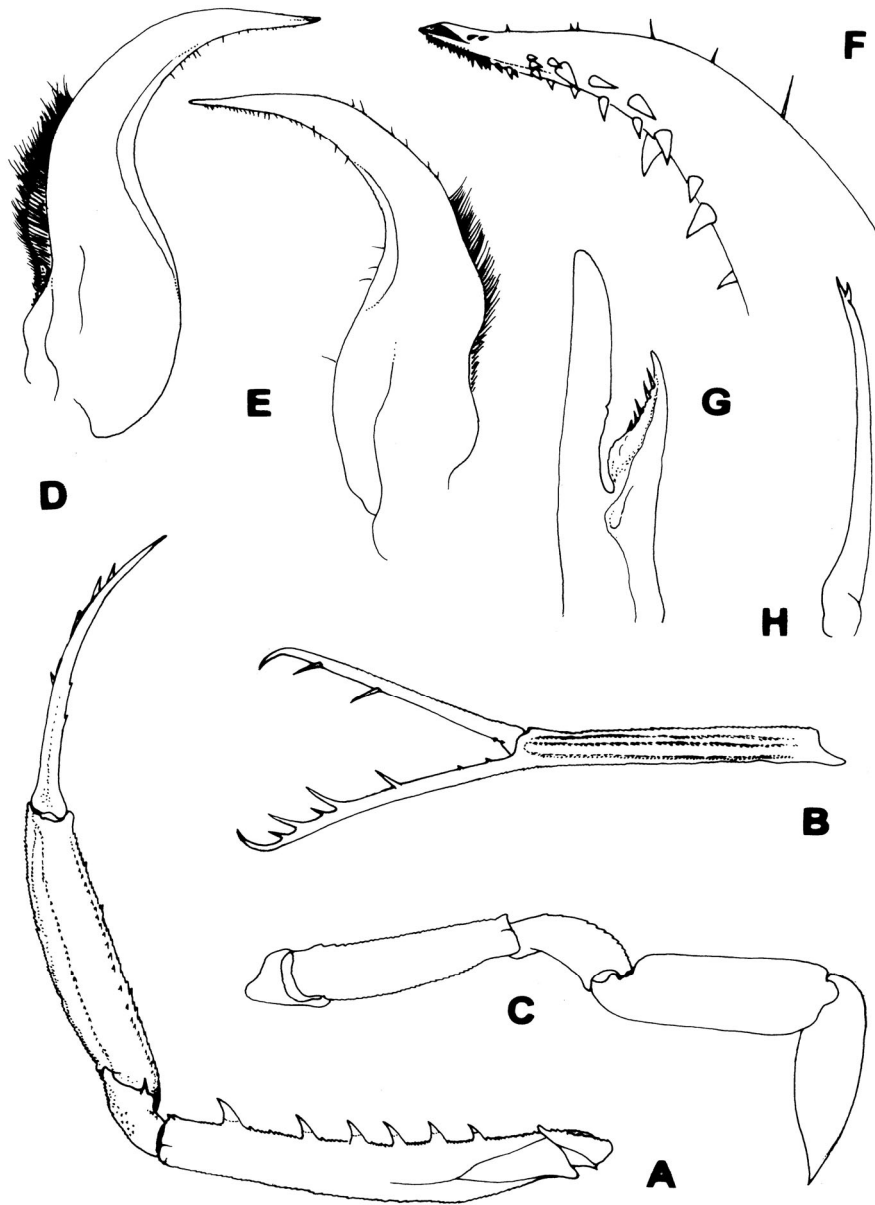


Figure 5. *Atoportunus gustavi*, new species. Holotype male (16.1 by 8.8 mm) (UF 2091). A, left cheliped; B, left chela; C, right fifth ambulatory leg; D-F left G1; G, left G2; H, tip of left G2 showing furca-like structure.

bicristate, outer margin lateral to each lobe very low, not demarcated from lobe by cleft or fissure, separated from rest of supraorbital margin by broad oblique cleft just at base of eyestalk. Orbits very small, eyes reduced, with eyestalk very short, cornea small. Supraorbital margin concave, semicircular from dorsal view, with small submedian fissure; margin ridged; outer angle lobiform, forming low external orbital tooth. Infraorbital margin almost smooth, concave; inner angle with distinct broadly triangular blunt tooth which is just visible from dorsal view; outer edge confluent with external orbital tooth. Antero- and posterolateral margins clearly demarcated by last anterolateral tooth. Anterolateral margin convex, with 7 prominent lobes or teeth (including external orbital lobe); first tooth low, rounded, anterior edge not reaching level of tip of second tooth which projects anteriorly, separated from second tooth by broad notch; second tooth lobiform, tip broadly rounded; third to seventh teeth dentiform, tips sharp, last tooth longest, directed laterally; margins, including those on teeth/lobes and spaces between them lined with sharp denticles or granules. Posterolateral margin gently concave to almost straight, distinctly converging posteriorly to and meeting posterior carapace margin gradually; anterior one-third of posterolateral margin lined with denticles or granules. Posterior carapace margin gently convex to almost straight. Posterior margin of epistome with broadly triangular median lobe, separated by distinct fissure; lateral margin with distinct fissure. Epibranchial ridge lined with row of granules, joins tip of last tooth; those on last anterolateral tooth fused to varying degrees. Mesobranchial ridge lined with low granules, not joining anterolateral margin. Protogastric ridges not clearly separated from mesobranchial ridges, very low, not clearly discernible, with scattered low granules. Short longitudinal median row of granules between mesogastric regions. H-shaped median groove shallow. Basal antennal segment longitudinally rectangular, simple, not completely lodged in orbital hiatus, still quite mobile; flagellum relatively long. Antennules folding obliquely. Ischium of third maxilliped subrectangular, with relatively shallow but distinct longitudinal median sulcus; merus almost squarish, antero-external angle rounded; ischium separated from basis by complete suture; exopod relatively short, stout, distal part almost distal edge of merus.

Chelipeds symmetrical, very slender, elongate. Fused basis-ischium with low spine on inner distal angle. Merus very slender, inner margin with 6 prominent spines, rest of margin lined with sharp granules; outer margin lined with sharp granules, appears serrated. Carpus very slender, with distinct spine on inner distal angle; dorsal surface covered with small granules. Palm very slender, elongate, dorso-ventrally compressed, appearing transversely ovate in cross-section; inner sub-dorsal surface with 2 faint rows of small spines; outer surface with 4 discernible costae, lined with small granules; fingers very long, styliform, gently curving inwards, tip strongly hooked; cutting edge of dactylus with 2 spines;

cutting edge of pollex with 5 spines of various sizes; fingers closing tightly, with cutting edge spines on one finger crossing with opposing spines of other finger.

Merus, carpus and propodus of ambulatory legs very slender, laterally compressed, surfaces almost smooth; merus with dorsal and ventral margins finely granular, dorsal margin with low distal tooth; carpus with dorsal margin weakly serrated; propodus elongate, rectangular, subfoliaceous, margins almost smooth; dactylous spatuliform, unarmed, without ridges. First and second leg longest, last leg shortest. Dactylus of first to third ambulatory dorso-ventrally compressed, subspatuliform. Dactylus of first to third legs very long, slender, styliform.

Anterior thoracic sternum relatively wide; surfaces almost smooth to finely granular. Sternites 1 and 2 separated by faint suture. Sternites 2 and 3 separated by faint suture which is concave towards abdomen. Sternites 3 and 4 separated by very shallow groove which is medially interrupted, appearing to merge with deep longitudinal median groove on sternite 4 which leads from abdominal cavity. Press button abdominal locking mechanism near posterior margin of sternite 5.

Male abdomen triangular; telson triangular, lateral margins almost straight, tip relatively pointed; segment 6 trapezoidal, with lateral margins gently concave. Segments 3-5 completely fused, without trace of sutures or lateral clefts. Segment 2 very broad transversely, narrow longitudinally, lateral margins gently convex to straight. Segment 1 less transversely broad than segment 2, very narrow longitudinally. Penis coxal.

G1 curving laterally outwards, broadly C-shaped; stout proximally but tapering distally; distal part with numerous short, posteriorly directed spines and scattered simple short setae, no long setae present; opening dorsal, slit-like. G2 ca. 0.8 times length of G1; basal segment elongate; distal segment very short, forming furca-like structure with strong setae at cup-like junction between segments.

Females and others: There are no major differences in morphology except for the reproductive structures. None of the females have the abdomen so broad as to cover most of the thoracic sternum but are already clearly adult. The smallest specimen (6.0 by 3.8 mm, UF 2092), a young male, is very similar to the other males, but the inner margin of the merus of the cheliped only has three well developed spines.

Colour: Dark-orangish to dull strawberry-red on dorsal surfaces (Fig. 1A, B). The thoracic sternites 1-3 are a bright reddish-pink in life, with the rest of the ventral surfaces dirty white.

Etymology: We take great pleasure in naming this species after Gustav Paulay, who started us on this study and whose intrepid collecting has uncovered this species in Guam and Hawaii!

Remarks: On the basis of the material on hand, *Atoportunus gustavi*, new species, does not appear to show any sexual dimorphism, even in the form of the chelipeds, although the available specimens suggest that males are somewhat smaller than females. None of the female specimens, even the largest ones, have

the abdomen fully covering or covering most of the thoracic sternum, but they are nevertheless adult as their pleopods are fully developed and setose.

The specimens from Japan and Christmas Island do not differ from the types from Guam in any major characters, although both are the largest specimens of the species known. Unfortunately, males of *A. gustavi* are not known outside Guam. The conspecificity of the Indian Ocean specimen with the Guam and Japanese material is surprising, but not unique. A newly described species of cavernicolous xanthid crab of the genus *Neoliomera* has the same distribution (Ng, 2002).

On the basis of the collection data, *A. gustavi* occurs primarily in coral rubble, which is effectively an identical habitat to caves. Only one specimen collected from Apra Harbour was not from such a habitat, but it may have wandered out from its normal habitat into a silty environment with low light conditions. According to Harry Conley, who collected all the specimens, *A. gustavi* is a nocturnal species and is normally found in dark places, but he has observed them from under boulders and rocks. The habitat preference of *A. gustavi* can best be described as chalicophilous (from the Greek “chalix” for rubble, alluding to their tendency to live among coral rubble), with cavernicolous tendencies (the Japanese and Christmas Island specimens were from inside caves).

One specimen from Glass Breakwater in Guam was kept in the aquarium by B. Hencke for two weeks and several days after that by the first author. According to Hencke, it adapted well to captive conditions, feeding on fish meat presented to it and was not unduly affected by the light. When disturbed, it spreads its slender chelipeds laterally (Fig. 1B), a threat posture similar to that of many portunid species. The first author observed this specimen for a few days before it was preserved, and in most ways, it behaves like many other more typical swimming crabs, using its paddle-like last pair of ambulatory legs to dig into the sand. It can swim, albeit rather clumsily, at least in the small aquarium it was contained in.

Atoportunus pluto, new species
(Figs. 1C, 6-8)

Material examined: Holotype – female (23.5 by 12.9 mm) (UF 2095), “Gustav’s Cave”, Kona coast, Hawaii, 2-9 m, 19°19'06.6"N, 155°53'05.4"W coll. R. De Felice, 30 October 1997. Paratypes – 2 males (19.4 by 16.7 mm, NSMT 14216; 13.5 by 8.1 mm, ZRC 2002.170), same location as holotype, coll. T. Kase, 31 October 1997.

Diagnosis: Anterolateral margin with first 4 teeth lobiform, not spine-tipped; next 3 sharp, spine-tipped. Epibranchial ridge lined with series of granules, many of which have sharp tips; mesobranchial ridge lined with distinct granules. Merus of cheliped slender, inner margin with 4-6 prominent spines;

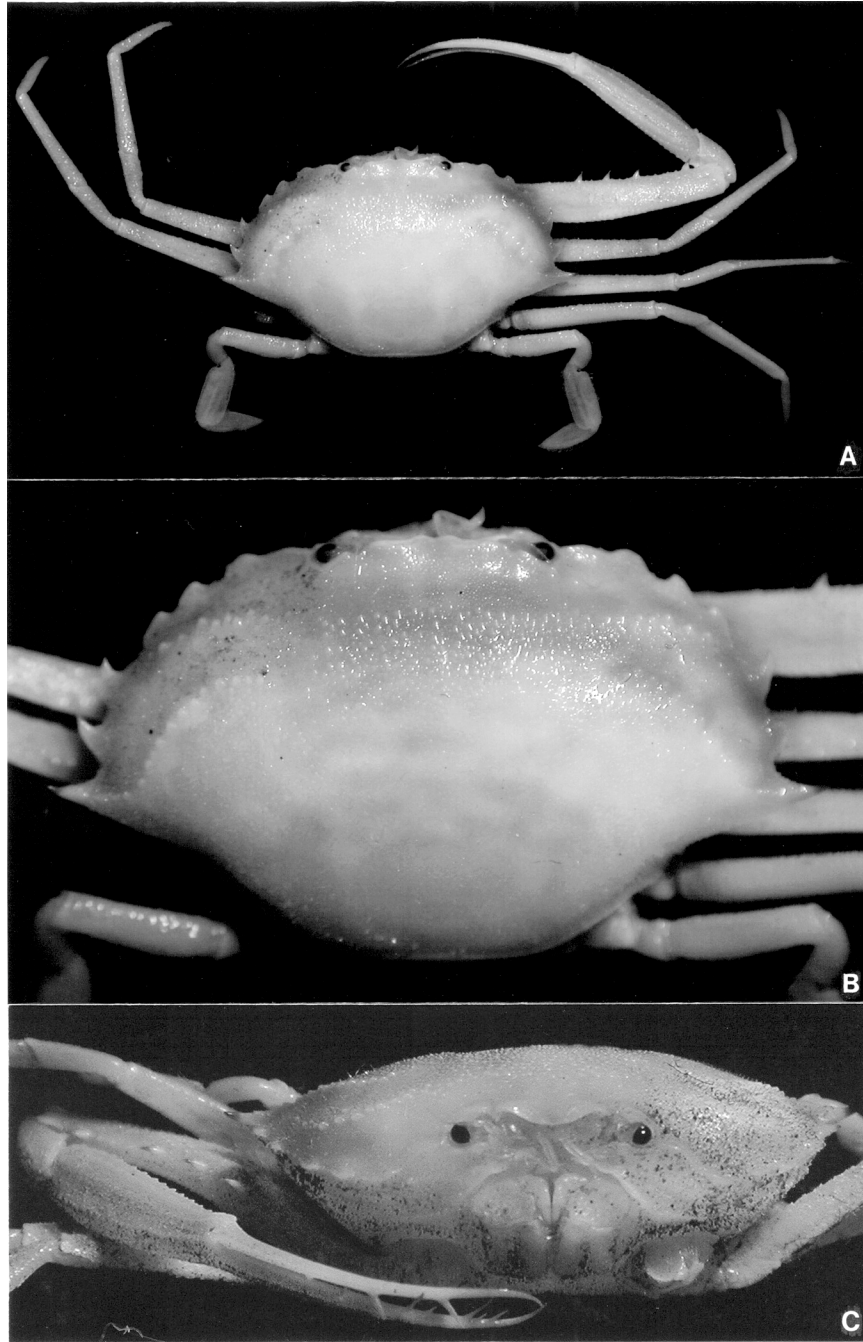


Figure 6. *Atoportunus pluto*, new species. Holotype female (23.5 by 12.9 mm) (UF 2095). A, overall view; B, carapace; C, frontal view.

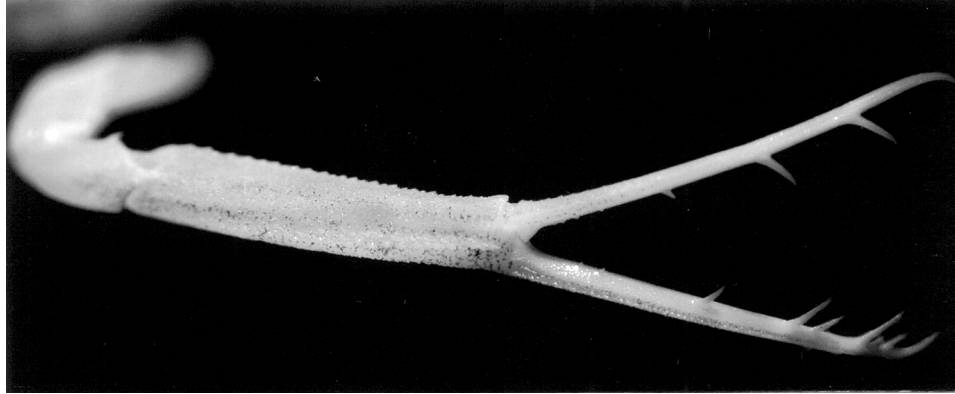


Figure 7. *Atoportunus pluto*, new species. Holotype female (23.5 by 12.9 mm) (UF 2095), right chela.

carpus slender; cutting edge of dactylus with 2-3 spines; cutting edge of pollex with 5-6 spines. Merus, carpus and propodus of ambulatory legs slender.

Colour: Dorsal surfaces orangish, with ventral surfaces mostly dirty white (Fig. 1C).

Etymology: This species is named after Pluto, god of the netherworld, alluding to the habits of the species. The name is used as a noun in apposition.

Remarks: *Atoportunus pluto*, new species, and *A. gustavi*, although superficially similar, can easily be distinguished by several characters. Compared to *A. gustavi*, *A. pluto* has proportionately stouter and shorter chelipeds and ambulatory legs (all segments). This difference is independent of size or sex. In addition, the granules present on the dorsal surface of the carapace, especially those on the epibranchial and mesogastric ridges tend to be fewer in number but are relatively larger, more conical and sharper. For example, males of *A. pluto* have only about four distinct sharp granules on each mesobranchial ridge and eight to 10 on the epibranchial ridge. In similar sized males of *A. gustavi*, there are far more granules but these are proportionately smaller, lower and more closely packed. The same situation is true for similarly sized females. In addition, in *A. pluto*, the inner margins of the merus of the cheliped are more prominently spinate, with the denticles larger, although they tend to have fewer large spines (4-6 vs. always 6 in *A. gustavi*). The G1 structures do not differ significantly, although that of *A. gustavi* has the distal part somewhat more slender. There also appears to be minor differences in coloration. Live *A. pluto* is generally a pale orange (Fig. 1C), while *A. gustavi* is a dull strawberry-red (Fig. 1A, B).

All three specimens of *A. pluto* have been obtained from caves and their habits are probably similar to *A. gustavi*.

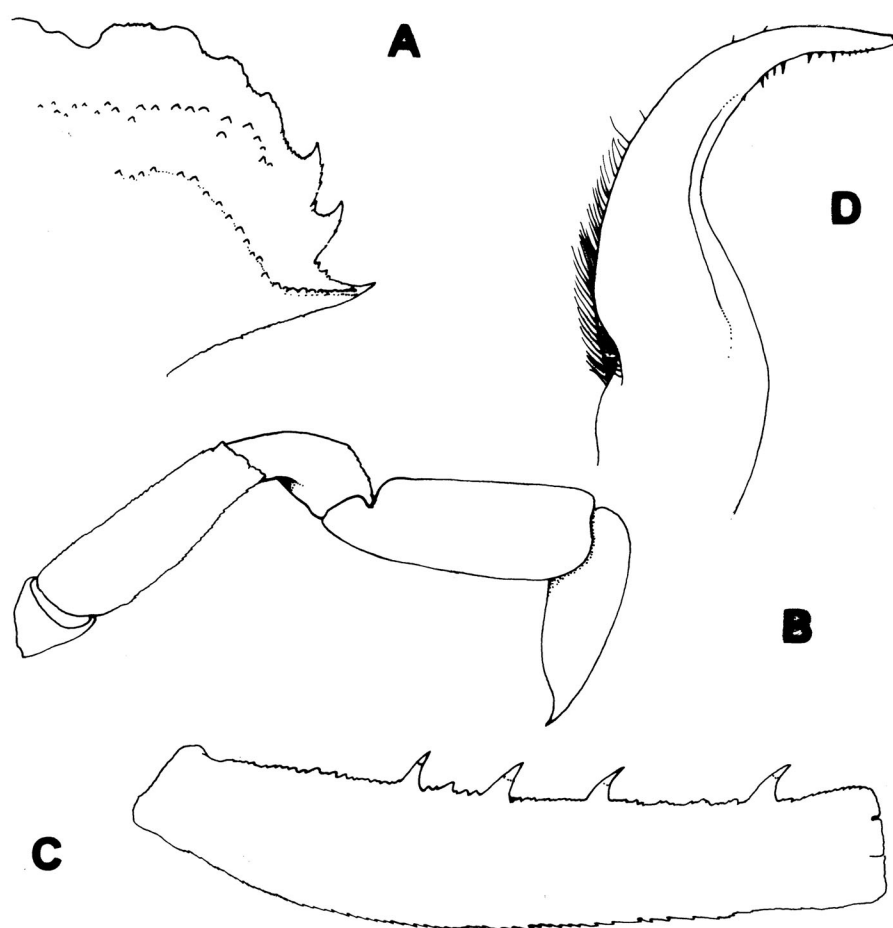


Figure 8. *Atoportunus pluto*, new species. A-C, holotype female (23.5 by 12.9 mm) (UF 2095); D, paratype male (19.4 by 16.7 mm) (NSMT 14216). A, right side of carapace; B, right fifth ambulatory leg; C, right merus of cheliped; D, left G1.

Acknowledgements

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