

Otognathon uru, a New Species of Varunid Crab (Decapoda: Brachyura: Grapsoidea) from an Intertidal Reef in Okinawa Island, the Ryukyu Islands, Japan

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Abstract A new species of the brachyuran genus *Otognathon* Ng and Števcíć, 1993 is described and illustrated on the basis of material from Okinawa Island, Ryukyu Islands, Japan. The new species is distinct from its only known congener, *O. komodoense* (Serène, 1971), in characters of the carapace, third maxillipeds, chelipeds, and ambulatory legs. The new species confirms that *Otognathon* is a thoracotreme genus and that it should be assigned to the family Varunidae.

Key words: Decapoda, Brachyura, Varunidae, *Otognathon*, new species, Ryukyu Islands, Japan.

The brachyuran crab genus *Otognathon* Ng and Števcíć, 1993, was established for *Dentoxanthus komodoensis* Serène, 1971, which is known only from the female holotype. The key characters that separate *Otognathon* from *Dentoxanthus* Stephensen, 1946 *s. str.* include the shape of the carapace, the structure of the third maxilliped and the armature of the cutting edges of the fingers. Ng *et al.* (2008) subsequently argued that *Otognathon* was not a pilumnid but more likely a varunid. Recently, we obtained male and female specimens of an undescribed species from Okinawa Island, the Ryukyus, Japan, clearly referable to *Otognathon*. The Japanese specimens are distinct from *O. komodoense* in the structures of the carapace, third maxillipeds, chelipeds and ambulatory legs. In this study, we describe a new species, *Otognathon uru*. The collection of male specimens of the new species also enabled us to confirm the systematic position of *Otognathon* as a thoracotreme crab within the family Varunidae.

Measurements (in millimeters) are of the carapace width and length, in that respectively. G1

and G2 are used for the male first and second pleopods respectively. Specimens used in this study are deposited in the National Museum of Nature and Science, Tokyo, Japan; Natural History Museum and Institute (CBM), Chiba, Japan; Ryukyu University Museum, Fujukan (RUMF), University of Ryukyus, Japan; and Zoological Reference Collection (ZRC), Raffles Museum of Biodiversity Research, Department of Biological Sciences, National University of Singapore.

For comparative purpose, the following material was examined.

Otognathon komodoense (Serène, 1971). Holotype: ZRC 1969.12.25.1, female (8.2×7.6 mm), coral substrate, Komodo Island, Indonesia, coll. K. Romimohtarto, “Operation Baruna I”, 27 May 1964.

Taxonomy

Family **Varunidae** H. Milne Edwards, 1853

Subfamily **Varuninae** H. Milne Edwards, 1853

Genus **Otognathon** Ng and Števcíć, 1993

[New Japanese name: Rokkaku-iso-gani zoku]

Dentoxanthus – Serène, 1971: 906.

Otognathon Ng and Števcíć, 1993: 101; Ng *et al.*, 2008: 228.

Type species. *Dentoxanthus komodoensis* Serène, 1971, by original designation.

Diagnosis. Carapace subhexagonal; dorsal surface weakly uneven, rugose, with oblique blunt ridge extending from middle portion of protogastric region to prominent, blunt lateral tooth arising at junction between anterolateral and posterolateral margins; entire lateral margin of carapace minutely granular; front somewhat produced anteriorly; anterolateral margin with entire or some obsolete lobes. Orbital hiatus completely filled by mobile basal antennal peduncle. Basal article of antennular peduncle large, distal 2 articles folded obliquely. Distal 3 articles of antennal peduncle articulated. Lateral endostomial palatal ridges defining efferent branchial channels, weak but distinct. Third maxilliped with anterolateral angle of merus distinctly auriculiform, weakly expanded with convex margin; granules present in longitudinal submedian sulci of merus and ischium; dactylus slender, with tuft of short setae; exopod narrow, less than half width of ischium or merus. Chelipeds of mature males not particularly enlarged; outer surface of palm of cheliped generally smooth, but with ventrodiscal row of small granules proximal to base of immovable finger; dactylus slightly longer than palm measured along dorsal margin. Ambulatory legs compressed, anterior and posterior margins of meri sharply carinate; merus of fourth ambulatory leg (=fifth pereopod) with raised granular ridge along entire dorsal midline. Abdomen with six somites and telson, all somites freely movable. Male gonopore on sternite 8, separated from coxa of fifth ambulatory leg or sternite 7. G1 moderately slender, curving dorso-

laterally, reaching to level of suture between thoracic sternites 4 and 5. Vulva raised, convex, and circular in shape.

Remarks. The systematic position of the type species of *Otognathon*, *Dentoxanthus komodoensis*, has always been difficult to determine precisely because the only known specimen is a small female. The species was first regarded as the second species of *Dentoxanthus* (Serène, 1971), and later transferred to its own genus *Otognathon* by Ng and Števcíć (1993). The genus had long been affiliated with the “xanthoids”, originally placed in the Eumedoninae (Pilumnidae) and subsequently to the Pilumnidae sensu stricto (see Števcíć and Ng, 1988). Števcíć (2005) placed *Dentoxanthus* s. str. in its own subfamily, the Dentoxanthinae Števcíć, 2005, in the Pilumnidae, superfamily Pilumnoidea. A detailed reappraisal by Ng *et al.* (2008: 137, 228) showed that on the basis of the structure of the chelipeds, ambulatory legs and abdomen, *Otognathon* was more likely to be a member of the Varunidae and was transferred there. We agree with their observations and there is no need to discuss this further here. The present male specimens of the new species have made clear that *Otognathon* has characters that are diagnostic of the Thoracotremata and Varunidae, such as the presence of a mobile basal article of the antenna, a penis which extends directly from thoracic sternite 8, a setose inner surface of the chela, pectinate tips on the cheliped fingers, and a straight and well-calcified G1.

Some degree of similarity is seen among *Otognathon*, *Utica* White, 1847, *Scutumara* Ng and Nakasone, 1993, and *Noarograpsus* Ng, Manuel and Ng, 2006. Differentiating characters among the four genera are summarized in Table 1. The carapace proportion, of which the length is greater than width, is a character shared by *Otognathon* and *Scutumara*. *Otognathon*, *Utica* and *Noarograpsus* resemble each other in the uneven dorsal surface of the carapace. Nevertheless, *Otognathon* has a number of unique characters. The lateral margins of the carapace bear a prominent blunt tooth at the junction of the anterolater-

Table 1. Summary of generic characters of *Otognathon* Ng and Stevcic, 1993, *Scutumara* Ng and Nakasone, 1993, *Utica* White, 1847, and *Noarograpsus* Ng, Manuel and Ng, 2006.

Characters/Genera	<i>Otognathon</i>	<i>Scutumara</i>	<i>Utica</i> sensu lato	<i>Noarograpsus</i>
Carapace ratio	length greater than width	length greater than width	width greater than length	width greater than length
Carapace shape	subhexagonal in shape	subquadrangular in shape	quadrangular in shape	subcircular in shape
Carapace surface	Carapace uneven, naked	smooth, naked	uneven, covered with dense pubescence	uneven, naked
Carapace regions	not clearly defined	not clearly defined	clearly defined	clearly defined
Frontal margin of carapace	bilobed	entire, sinuous	entire, sStraight	bilobed
Tooth the at the junction of anterolateral anterolateral and posterolateral margin of carapace	present	absent	absent	absent
Ridge on carapace	present, extending towards anteriorly towards gastric region	absent	present, extending horizontally across posterior one-third of carapace	absent
Longitudinal sulci on the merus and ischium of the third maxilliped	with granules	without granules	without granules	without granules
Outer surface of palm of chela	densely granular	smooth	smooth	sparsely granular
Median ridge on dorsal surface of fifth ambulatory leg	present	absent	absent	absent
Margins of ambulatory legs	propodi and dactyli sparsely setose	all segments naked	all segments setose	all segments naked
Extension of G1 anterior margin	reaching anterior margin of thoracic sternite 5	not reaching anterior margin of thoracic sternite 5	not reaching anterior margin of thoracic sternite 5	not reaching anterior margin of thoracic sternite 5
Distal end of G1	simple	simple	simple	bilobed

al and posterolateral margins, making the general outline of the carapace subhexagonal; the dorsal surface of the carapace is provided with low oblique ridge extending from the lateral blunt tooth to the protogastric region on either side of the midline; the longitudinal sulci on the merus and ischium of the third maxilliped are filled with granules; the outer surface of the palm is densely granular; the merus of the fifth ambulatory leg bears a distinct longitudinal ridge on the midline of the dorsal surface; and the G1 reaches to the anterior margin of the thoracic sternite 5. In the other three genera, there is no prominent tooth arising at the junction of the anterolateral and posterolateral margins of the carapace; there are no oblique ridges on the dorsal surface of the carapace extending from the protogastric region to the lateral margin; longitudinal sulci on the third maxilliped are non-granular; and the outer surface of the palm is smooth in *Utica* and *Scutumara*, sparsely granular in *Noarograpsus*; the dorsal surface of the merus of the fifth ambulatory leg is smooth; and the G1 does not reach the anterior margin of the thoracic sternite 5.

Furthermore, *Otognathon* differs from at least some species of *Utica* by having a weakly bilobed front, a faintly lobed anterolateral margin of the carapace, the absence of a V-shaped ridge on the gastric region, and the transverse ridge across the posterior one-third of the carapace (this ridge is absent in some species of *Utica*, suggesting the need of a reappraisal of the genus), the absence of a dense pubescence covering the dorsal surface of the carapace, the relatively small male cheliped, and the relatively short, non-setose ambulatory legs. In *Utica* the front is truncate and straight; the anterolateral margins are dentate; the dorsal surface of the carapace bears dense covering of short pubescence; and the outer surface of the palm is smooth and the ambulatory legs are setose. *Otognathon* also differs from *Scutumara* by the bilobed front and the rugose dorsal surface of the carapace. In *Scutumara*, the front is broadly convex without a median notch; the dorsal surface of the carapace is smooth; and the outer surface of

the palm of chela is smooth. *Otognathon* differs from *Noarograpsus* in the poorly defined regions of the carapace, the relatively short and broad telson in the male, and the simple distal part of the G1. In *Noarograpsus*, the regions of the carapace are clearly defined; the G1 does not reach the anterior margin of thoracic sternite 5, and the distal part is distinctly bilobed.

***Otognathon uru* sp. nov.**

[New Japanese name: Rokkaku-iso-gani]

(Figs. 1–3)

Materials examined. Holotype: NSMT-Cr 19743, male (4.0×4.1 mm), Yakata-Katabaru, Onna Village, Okinawa Island, Japan, coll. T. Saeki, 1 April 2007.

Paratypes: CBM-ZC 9518, 1 male (3.4×3.9 mm), Seragaki Beach, Onna Village, Okinawa Island, Ryukyu Islands, coll. J. Sasaki, 14 March 2001; CBM-ZC 9519, 1 male (3.5×3.6 mm), 1 female (3.7×3.8 mm), Yakata-Katabaru, Onna Village, Okinawa Island, coll. T. Saeki, 1 April 2007; RUMF-ZC-861, 2 males (2.6×3.2, 2.7×3.2 mm), 1 female (2.7×2.8 mm), same data; ZRC 2008.0021, 1 male (3.0×3.1 mm), 1 female (4.0×4.1 mm), same data; RUMF-ZC-00862, 1 male (4.5×4.6 mm), 2 females (4.4×4.5, 5.2×5.4 mm), Yamada, Onna Village, Okinawa Island, Japan, coll. T. Maenosono, 20 May 2007.

Description. Males. Carapace subhexagonal (Figs. 1, 2A) (length to width ratio ca. 1.1), dorsal surface rugose, regions slightly more defined than in most varunids; cervical groove not very distinct, shallow, broad; gastric grooves indistinct; epigastric ridges indistinct, postorbital cristae absent. Lateral margin lined with very small, rounded granules, with prominent, blunt tooth at junction of anterolateral and posterolateral margins; low oblique ridge extending from lateral tooth to protogastric region on dorsal surface. External orbital angle broad, anterolateral margin usually with 3 faint lobes in addition to external orbital angle and blunt tooth at junction between anterolateral and posterolateral margin;



Fig. 1. *Otognathon uru* sp. nov., holotype, male (4.0×4.1 mm, NSMT-Cr 19743). Habitus in dorsal view.

posterolateral margins gently convex before converging with slightly convex posterior margin; supraorbital margin granular, concave. Frontal margin granular, produced forward, slightly bilobed, lateral edges confluent with supraorbital margins, entire supraorbital margin strongly deflexed; infraorbital margins granular, not confluent with anterolateral margin, inner orbital tooth prominent, reaching midlength of antennal peduncle; suborbital region with distinct row of round granules adjacent to infraorbital margin, extending to subbranchial region (Fig. 2D).

Eyes (Fig. 2B) well developed, short; cornea darkly pigmented; eyestalk wider than long. Basal article of antennular peduncle broad. Antennal peduncle entering orbital hiatus; basal article mobile.

Inter-antennular septum broad, triangular. Epistome (Fig. 2C) narrow, anterior margin granular, median part with larger granules; posterior margin with 2 lateral clefts, median region broadly triangular, margin with numerous rounded granules.

Third maxillipeds (Fig. 2D) broad, leaving very narrow rhomboidal gape when closed. Merus about 0.9 times longer than wide, an-

teroexternal angle strongly auriculiform, granular on outer margin; single granular sulcus present on outer surface submedially. Ischium stout, about 1.2 times longer than broad, with single granular sulcus, outer margin granular, inner margin densely setose. Exopod distinctly narrower than ischium; flagellum short, sparsely setose.

Chelipeds of mature males subequal, similar, not particularly enlarged or elongate, surfaces punctate. Palm weakly swollen, without patch of soft setae at base of fingers on outer surface; ventral margin slightly sinuous. Fingers subequal to or slightly longer than palm measured along dorsal margin, pointed at tips, not crossing, no hiatus (Fig. 2E). Dactylus with 3 longitudinal ridges extending nearly to tip on outer surface, and also with 2 ridges on inner surface; cutting edge with row of small, unequal subacute teeth, distal part bordered with chitinous ridge. Fixed finger straight, with row of blunt or subacute teeth, distal part also bordered with chitinous ridge. Palm slightly higher than long, surfaces densely granular; dorsal surface flattened, delimited by outer and inner ridges; outer surface with 2 longitudinal ridges, dorsal ridge extending from base of dactylus nearly to proximal margin, and ventral

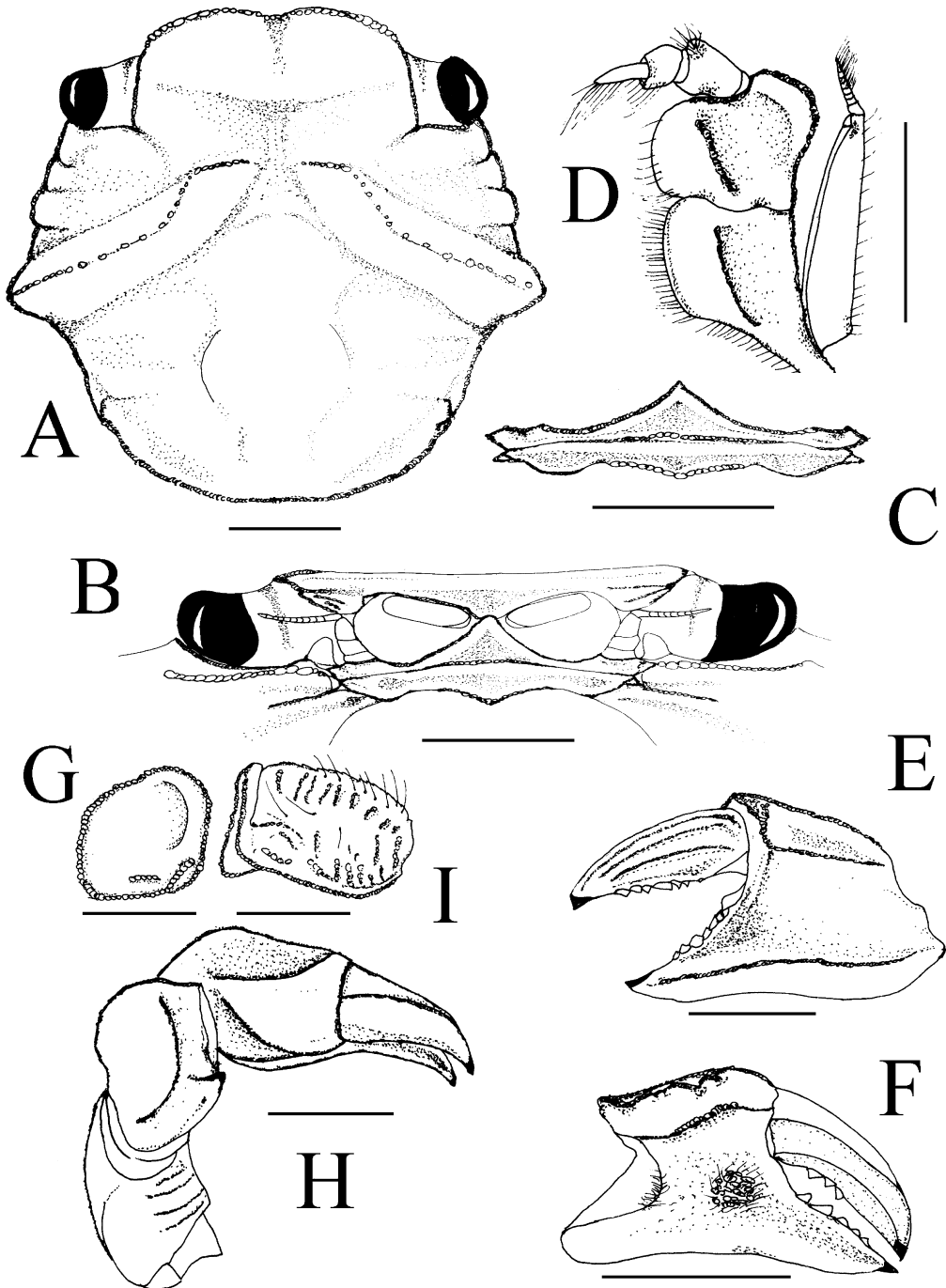


Fig. 2. *Otonathon uru* sp. nov. Holotype, male (4.0×4.1 mm, NSMT-Cr 19743). A, carapace and eyes, dorsal view; B, frontal region of carapace and cephalic appendages, frontal view; C, epistome, frontal view; D, left third maxilliped, outer view; E, left chela, outer view; F, left chela, inner view; G, carpus of left cheliped; H, right cheliped, anterior view; I, merus of left cheliped, outer view. Scales: 0.5 mm.

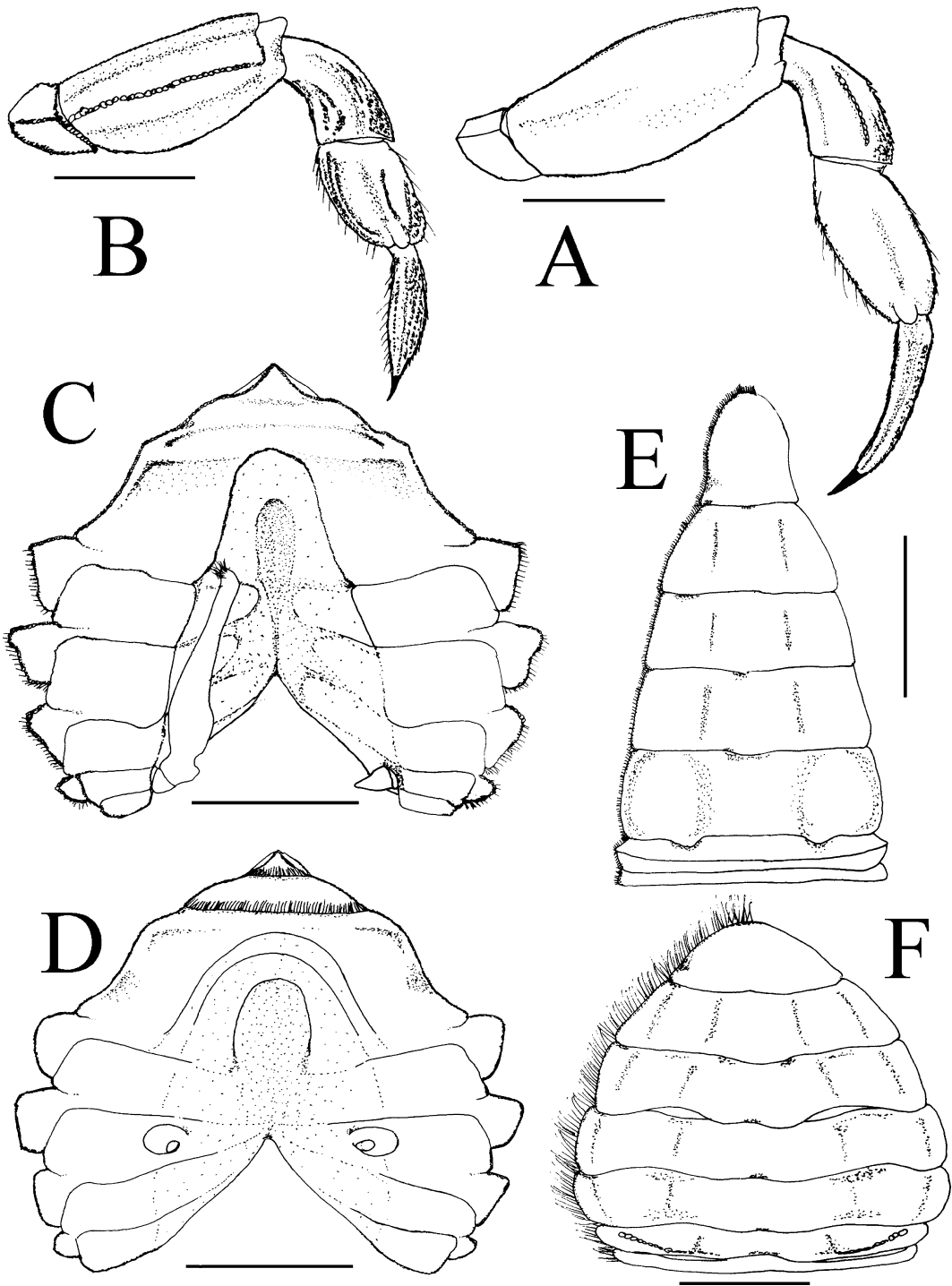


Fig. 3. *Otognathon uru* sp. nov. A, B, C, E, holotype, male (4.0×4.1 mm; NSMT-Cr 19743); D, F, paratype, female (4.0×4.1 mm; ZRC 2008.0021). A, right third ambulatory leg, dorsal view; B, right fourth ambulatory leg, dorsal view; C, D, sternum; E, F, abdomen. Scales: 0.5 mm.

ridge extending onto fixed finger; inner surface with small setal patch at middle portion (Fig. 2F). Carpus rounded, margins granular (Fig. 2G), inner distal angle with obtuse tooth (Fig. 2H). Merus with short vertical granular ridges on posterior (outer) surface; margins bordered by granules (Fig. 2I).

Ambulatory legs (Fig. 1) compressed; second ambulatory leg longest; surface of segments punctate. Anterior margins of meri, with small granules, ending with blunt subdistal tooth; outer surfaces of carpi each with a row of small granules, extensor and flexor margins of propodi with few setae; dactyli rectangular in cross section, tapering to slender, acute tip, flexor margins sparingly setose in anterior three legs. Merus of third ambulatory leg with weakly raised midline, posterior margin convex (Fig. 3A); anterior margin of carpus spinulose; extensor and flexor margins of propodus with small granules; dactylus longer than propodus. Merus of fourth ambulatory leg with sharp median ridge on dorsal surface (Fig. 3B), posterior margin strongly convex; anterior (extensor) margin of carpus covered with granules; extensor and flexor margins of propodus with small granules; dactylus longer than propodus, moderately slender, sparsely setose.

Male thoracic sternum (Fig. 3C) with lateral margins of first 2 sternites finely granular; suture between sternite 1 and 2 not clear except for notch on lateral margins, suture between sternites 2 and 3 slightly concave posteriorly at lateral ends; lateral margins of sternites 3 and 4 slightly sinuous, deep groove demarcating position of suture short depression parallel to lateral margins of sternites 3 and 4; medial longitudinal groove at sternites 5 and 6 broad; deep, narrow medial longitudinal groove at sternites 7 and 8.

Abdomen narrowly triangular in outline, with 6 movable somites and telson (Fig. 3E); lateral margins with short, sparse setae; first somite very weakly arched, with transverse ridge over entire width; second abdominal somite longitudinally narrow; third abdominal somite wider than second, slightly swollen laterally; fourth somite broader but slightly shorter than fifth; fifth

somite with anterior and posterior margins straight, lateral margins subparallel; sixth somite subquadrate in shape, lateral margins slightly convex; telson roundly triangular, distinctly longer than broad, lateral margins weakly sinuous, margin adjacent to sixth somite almost straight.

Penis at outer edge of thoracic sternite 8 (Fig. 3C). G1 slender, curving dorsolaterally, reaching to or slightly beyond anterior margin of thoracic sternite 5; terminal lobe ending with pectinate tip bearing sparse setae (Figs. 4A–D). G2 short, small, twisted, narrowing towards bluntly rounded tip (Figs. 4E–G).

Females. Chelae similar to those of mature males, but generally slightly smaller; thoracic sternum relatively broader (Fig. 3D); abdomen rounded in shape (Fig. 3F). Vulva raised, convex, round (Fig. 4H) on thoracic sternite 6, with a small oval operculum.

Color. Color in life is not known. The colour of all preserved specimens ranges from dark cream to yellowish brown.

Distribution and habitat. So far known only from Okinawa Island, the Ryukyus, Japan. Specimens were found under fist-sized stones on intertidal flats with sand gravel substrates, which consist mainly of coral sands and foraminiferans (Toshifumi Saeki and Tadafumi Maenosono, pers. comm.).

Remarks. *Otognathon uru* sp. nov. differs from its only congener *O. komodoense* by several characters. The anterolateral margin of the carapace has at least three lobes in *O. uru*, but there is no distinct lobe in *O. komodoense*; the third maxilliped is relatively broader in *O. uru* than in *O. komodoense* (the merus is 0.9 times longer than wide versus 0.7 times; the ischium is 1.2 times longer than wide versus 1.4 times); the cheliped dactylus is proportionally shorter in *O. uru* than in *O. komodoense* (1.9 times longer than the palm versus 2.1 times); the outer surface of the chela is generally smooth in *O. uru*, but with large round granules in *O. komodoense*; the surface of the cheliped merus is granular in *O. uru*, smooth in *O. komodoense*; the ambulatory meri,

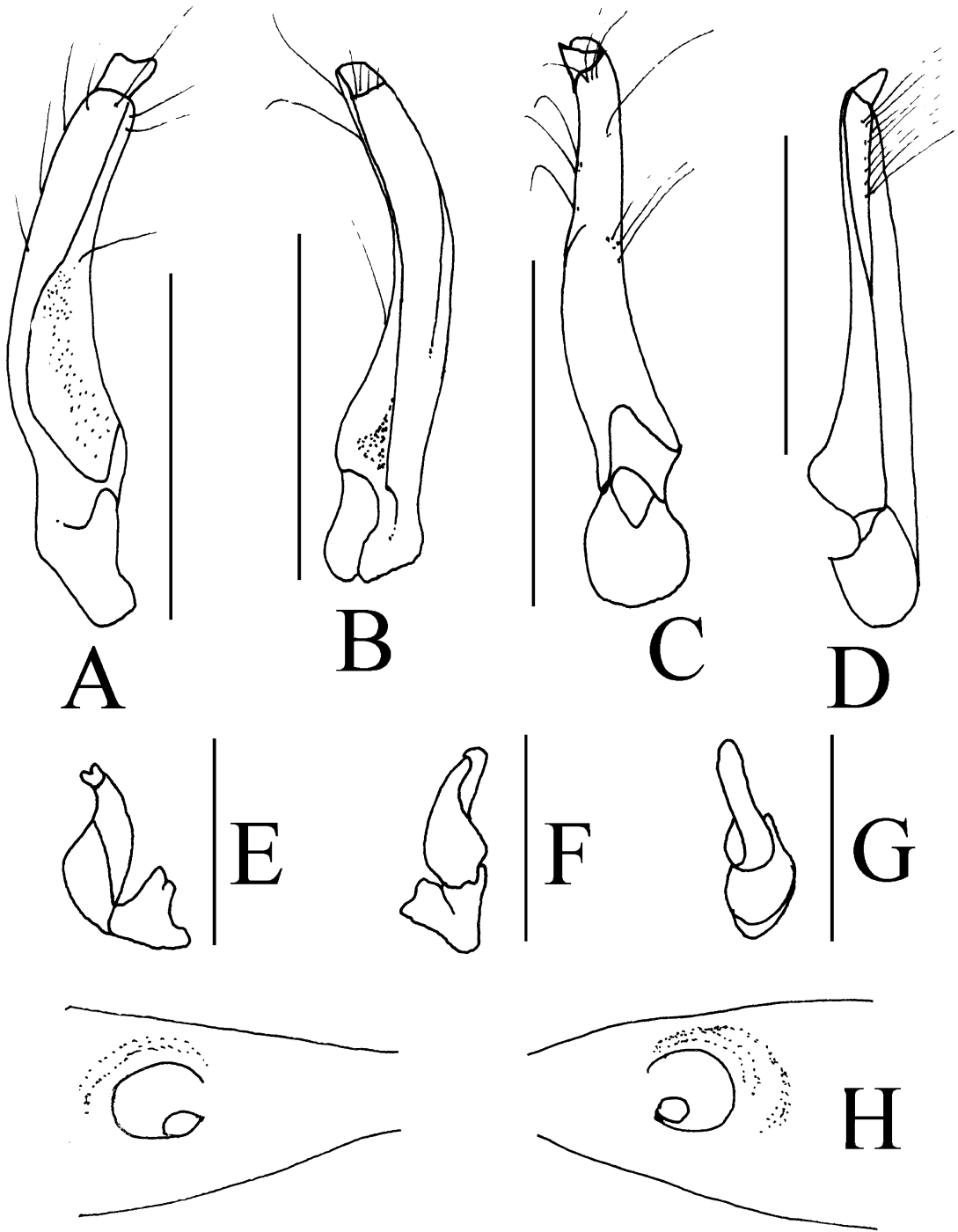


Fig. 4. *Otognothos uru* sp. nov. A, B, C, D, E, F, G, holotype, male (4.0×4.1 mm; NSMT-Cr 19743); H, paratype, female (4.0×4.1 mm; ZRC 2008.0021). A, G1, dorsal view; B, G1, ventral view; C, G1, lateral view; D, G1, mesial view; E, G2, ventral view; F, G2, lateral view; G, G2, dorsal view; H, vulva. Scales: A–D, H = 0.5 mm; E–G = 0.25 mm.

carpi and propodi are granular in *O. uru*, smooth in *O. komodoense*; the third and fourth ambulatory meri are proportionally longer and narrower in *O. uru* than in *O. komodoense* (length to width ratio in the third leg ca. 2.5 versus 2.2; ratio in the fourth leg 2.9 versus 2.2); the third ambulatory dactylus is proportionally more slender in *O. uru* than in *O. komodoense* (ca. 6.4 times longer than wide versus 5.8 times); and the fourth ambulatory dactylus is stouter in *O. uru* than in *O. komodoense* (4.0 times longer than wide versus 4.8). However, it must be noted that the characters that are based on the proportions of the different ambulatory legs should be used with caution; only similarly sized specimens of the same sex should be directly compared. The vulva is also more strongly raised in *O. uru* than in *O. komodoense*, being circular in *O. uru* but oval in *O. komodoense*.

Etymology. The name is derived from *uru*, which in the Ryukyu language means ‘pebbles made up of broken pieces of coral’, alluding to the pebble-like appearance of the carapace. The name is used as a noun in apposition.

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References

- Milne Edwards, H., 1853. De la famille des Ocypodides (Ocypodidae), suite. *Annales des Sciences Naturelles*, Série 3 (Zoology), **20**: 163–228, pls. 6–11. [A continuation of H. Milne Edwards, 1852, and reprinted in undated *Melanges Carcinologiques*, pp. 129–196.].
- Ng, N. K., M. R. Manuel and P. K. L. Ng. 2006. A new genus of varunid crabs from the Philippines (Crustacea: Decapoda: Grapsidae). *Proceedings of the Biological Society of Washington*, **119**: 49–57.
- Ng, P. K. L. and Y. Nakasone, 1993. *Scutumara enodis*, a new genus and species of grapsid crab (Decapoda: Brachyura) from Okinawa, Ryukyus, Japan. *Crustacean Research*, (22): 1–6.
- Ng, P. K. L. and Z. Števcíć, 1993. The identity of *Dentoxanthus komodoensis* Serène, 1971 (Crustacea: Decapoda: Brachyura: Pilumnidae) with description of a new genus. *Tropical Biodiversity*, **1**: 101–106.
- Ng, P. K. L., D. Guinot, and P. J. F. Davie, 2008. Systema Brachyurorum: Part I. An annotated checklist of extant brachyuran crabs of the world. *The Raffles Bulletin of Zoology*, Supplement, (17): 1–286.
- Serène, R., 1971. Observations préliminaires sur des brachyours nouveaux ou mal connus du sud-est asiatique (Crustacea Decapoda). *Bulletin du Muséum National d'Histoire Naturelle, Paris*, 2^e Série, **42**: 903–918.
- Stephensen, K., 1946. The Brachyura of the Iranian Gulf. With an appendix: The male pleopoda of the Brachyura. In: K. Jessen and R. Sparck (eds.), *Danish Scientific Investigations in Iran, Part 4*. Pp. 57–237. E. Munksgaard, Copenhagen.
- Števcíć, Z., 2005. The reclassification of Brachyuran Crabs (Crustacea: Decapoda: Brachyura). *Fauna Croatica*, **14**: 1–159.
- Števcíć, Z. and P. K. L. Ng, 1988. The systematic position of the genus *Dentoxanthus* Stephensen, 1945 (Crustacea Decapoda, Brachyura, Pilumnidae). *Steenstrupia*, **14**: 1–5.

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