

Crabs of the Genus *Quadrella* (Crustacea, Decapoda, Trapeziidae) from Japanese Waters

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Abstract A small collection of crabs of the genus *Quadrella* (Trapeziidae) was examined. This study revealed that, of three species previously recorded from Japanese waters, *Q. boopsis* ALCOCK, *Q. granulosa* BORRADAILE and *Q. maculosa* ALCOCK, the first two species should be corrected to *Q. bispinosa* BORRADAILE and *Q. coronata* DANA, respectively, and that *Q. reticulata* ALCOCK is newly added to the Japanese carcinological fauna. Descriptive and distributional information is given for the four Japanese species.

A small collection of crabs assembled by the junior author provided the impetus for reexamination of the Japanese species of *Quadrella* DANA, 1851—an obligate commensal of anthozoans. Up to date, *Q. boopsis* ALCOCK, *Q. granulosa* BORRADAILE and *Q. maculosa* ALCOCK have been recorded from Japanese waters by SAKAI (1965, 1976, 1980), MIYAKE and TAKEDA (1978), and MIYAKE (1983), but the meagre references in literature reflect paucity of material.

The present study based on the collections of the National Science Museum, Tokyo (NSMT) revealed that the inclusion of *Q. boopsis* and *Q. granulosa* into the Japanese carcinological fauna is due to misidentification and the specific names should be changed to *Q. bispinosa* BORRADAILE and *Q. coronata* DANA, respectively, and that *Q. reticulata* ALCOCK is newly added to the Japanese fauna.

Descriptive and distributional information is given here for the four Japanese species as well as detailed references to the literature. Much of the ground work for the specific assignments presented here was laid in the other publication dealing with the taxonomy of the group (GALIL, in press).

Family Trapeziidae

Genus *Quadrella* DANA, 1851

Quadrella bispinosa BORRADAILE, 1902

(Fig. 1)

Quadrella bispinosa BORRADAILE, 1902, p. 266, fig. 58; BARNARD, 1950, p. 819; GUINOT, 1967, p. 275;

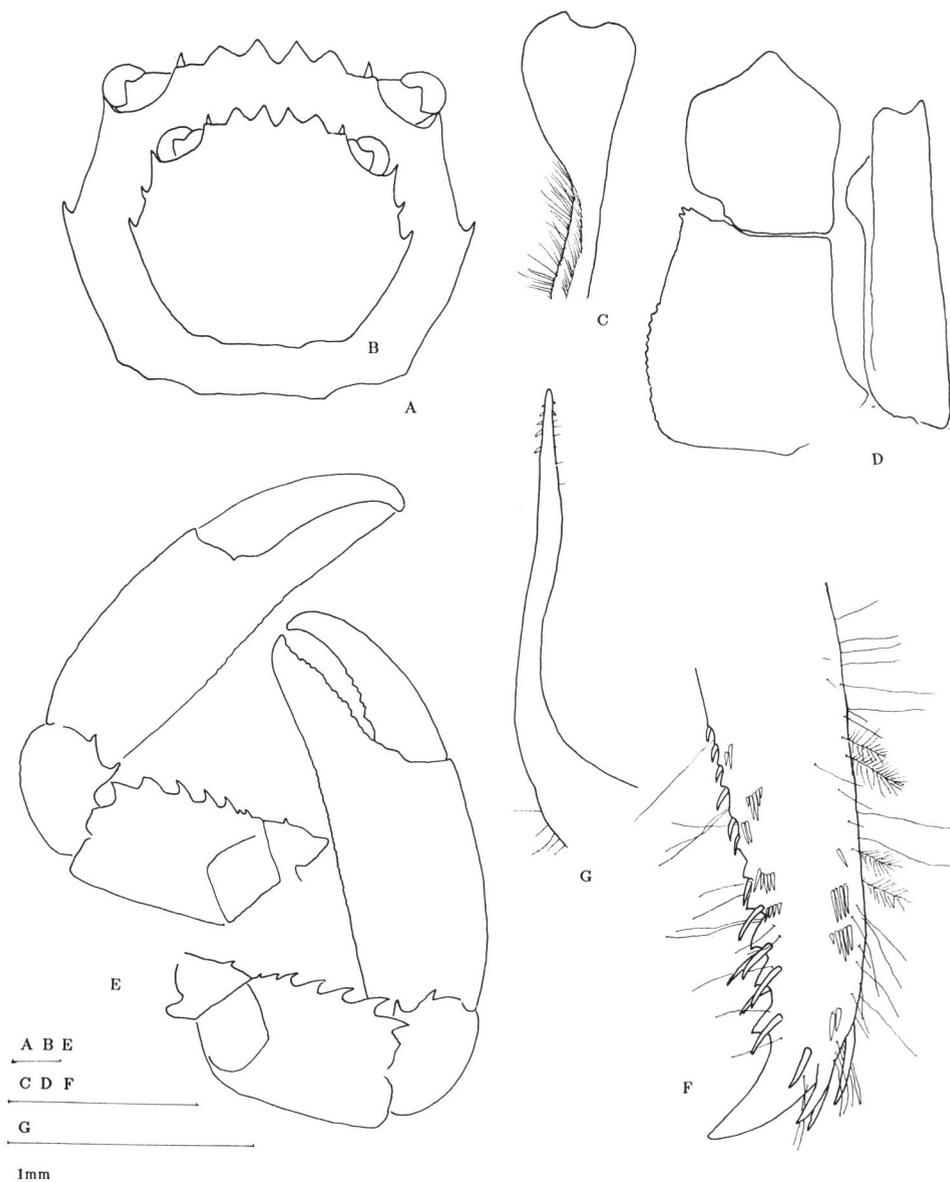


Fig. 1. *Quadrella bispinosa* BORRADAILE. A, C–E, female from Suruga Bay; B, male from Suruga Bay; F, G, male from Kushimoto. — A, B, carapaces; C, endopod of 1st maxilliped; D, 3rd maxilliped; E, chelipeds; F, 4th ambulatory dactyl; G, 1st pleopod.

SERÈNE, 1968, p. 89; 1973, p. 198.

Quadrella boopsis: SAKAI, 1965, pp. 163, 71, fig. 19, pl. 80 fig. 4; 1976, pp. 512, 316, pl. 184 fig. 2;

SERÈNE, 1975, p. 514, figs. 5–12, pl. 2 (part); 1984, p. 287, fig. 191, pl. 41a; MIYAKE, 1983, p. 140,

pl. 47 fig. 5.

Quadrella aff. *boopsis*: SERÈNE, 1973, p. 202, figs. 2, 14–16.

Material examined. Kushimoto, Kii Penin., 30–50 m deep; Aug. 1979; 1 ♂ (NSMT-Cr 6675); S. NAGAI leg. Suruga Bay, 15 m deep; Nov. 17, 1978; 1 ♂, 1 ovig. ♀ (NSMT-Cr 8425); K. SUZUKI leg.

Description. Carapace lenticular, sparsely decorated anteriorly with plumose setae. Frontal margin wide. Anterolateral margins straight, divergent posteriorly. Junction with posterolateral border marked by well developed epibranchial tooth. Frequently, midway between postorbital and epibranchial teeth, a conspicuous, acute spine. Posterolateral borders widely convex (Fig. 1A, B).

Submedian frontal lobes triangular, their edges finely dentate, separated by deep V-shaped sulcus and from outer lobes by shallower sinus. Outer pair of frontal lobes, not extending as far forward as submedian lobes, directed obliquely outward. Superior angles of orbits minutely tuberculate. Orbits quadrate; orbital margins minutely tuberculate. Inferior internal orbital tooth spiniform, incurved, visible beyond supraorbital angle, closer to frontal margin a second, smaller tooth. Postorbital tooth acute, prominent, directed forward.

Anterior margin of buccal frame sinuous, medially notched. Anterior margins of efferent canals well developed, rounded. Interantennular septum quadrate. Endognath of first maxilliped paddle-shaped, anterior margin scooped (Fig. 1C). Exognath of external maxilliped nearly columnar, inner margin slightly excavate, bearing flattened, rounded tooth distally. Inner margin of ischium of endognath inflated, proximally tuberculate, anterior distal angle tuberculate, outer margin oblique. Merus of endognath subquadrate; its outer distal angle produced, rounded, inner distal angle obliquely excavate; outer margin straight, inner margin rounded (Fig. 1D). Inner margin of both ischium and merus setose.

Chelipeds massive, subequal in both sexes. Anterior margin of ischium crenate, minutely tuberculate, median tubercle prominent. Merus projecting beyond edge of carapace, about 0.6 carapace length, its anterior margin with 7–8 curved triangular teeth increasing in size distally. On internal angle of carpus three tubercles, one proximal, two subdistal. Manus subcylindrical, minutely granulate, granules larger on carinate lower margin. Fingers long, their inner margins serrate (Fig. 1E). Ambulatory legs set with plumose setae. Inner margin of ambulatory propodi smooth, without spines. Apical dactylar tooth largest, cornute. On posterior margin of dactyl seven teeth successively smaller, closer, proximally; basally spinose. On interior surface short irregular rows of spinules. Long, curved spines distally on anterior surface (Fig. 1F).

Male pleopod slightly sinuous; subdistally with five spines on inner, two on outer margin (Fig. 1G).

Remarks. *Quadrella bispinosa* shares with *Q. nitida* SMITH relatively short chelipeds, sloping anterolateral borders, smooth posterior propodal margin and apical

dactylar tooth more prominent than teeth on posterior margin. However, *Q. nitida* differs from the former in the absence of intermediate spine, obtuse epibranchial spine, slender spines on merus of cheliped and presence of a single spine on anterior internal margin of carpus of cheliped.

BORRADAILE (1902) described *Quadrella bispinosa* from a single female dredged in the Maldives. The characteristic features—intermediate anterolateral spine, tuberculate supraorbital angle, relatively short, serrulate merus of cheliped—are all apparent in the well illustrated description.

Quadrella bispinosa was entered into synonymy with *Q. boopsis* ALCOCK by SAKAI (1965). Though *Q. boopsis* resembles *Q. bispinosa* in its short chelipedal meri; it lacks the midanterolateral spine, its ambulatory propodi are spinose, postorbital spine projects distinctly outwards and posterior margin of dactyl is armed with thirteen prominent teeth. The illustrations accompanying SAKAI's work clearly depict *Q. bispinosa*, its distinct carapace outline, sloping anterolateral borders and characteristic fourth ambulatory dactyl.

SERÈNE (1973: 198) noted the similarity between SAKAI's specimens and BORRADAILE's and wrote: "La ressemblance est frappante si on compare la figure de BORRADAILE (1902, fig. 58a) pour *bispinosa* avec celle de SAKAI (1965, pl. 80, fig. 4) pour *boopsis*." In discussing *Q. boopsis* SERÈNE (1973: 201) wrote: "Je fais une réserve sur l'identité du matériel de SAKAI (1965) avec l'espèce d'ALCOCK." SERÈNE (1973: 202) then described *Q. aff. boopsis*, which accompanying illustrations of ambulatory dactyl and pleopod (Figs. 2, 14–16) place without doubt in *Q. bispinosa*. In later works SERÈNE (1975, 1984) accepted SAKAI's opinion and synonymized *Q. aff. boopsis* and *Q. bispinosa* with *Q. boopsis*. However, his descriptions and illustrations (1975, figs. 5–12, pl. 2; 1985, fig. 191, pl. 41a) are plainly of *Q. bispinosa*.

Distribution. East Africa, Madagascar, Maldives, Vietnam, Indonesian waters, Japan.

Quadrella coronata DANA, 1852

(Fig. 2)

Quadrella coronata DANA, 1852a, p. 84; 1852b, p. 266; 1855, pl. 16 fig. 5; MIERS, 1886, p. 163 (footnote); ORTMANN, 1897, p. 210; ALCOCK, 1898, p. 266; BORRADAILE, 1902, p. 226; RATHBUN, 1911, p. 235; KLUNZINGER, 1913, p. 317; ESTAMPADOR, 1937, p. 531; BARNARD, 1947, p. 365; 1950, p. 281, fig. 52e, f; GUINOT, 1967, p. 275; SERÈNE, 1973, p. 205, figs. 5, 10, 23–26, pl. 4; 1984, p. 289, fig. 195, pl. 41f; SERÈNE *et al.*, 1974, p. 24; KENSLEY, 1981, p. 45; SERÈNE and VADON, 1981, p. 122.

Trapezia sp.?: MIERS, 1884, p. 536 (footnote).

Quadrella coronata var. *granulosa* BORRADAILE, 1902, p. 266; LAURIE, 1906, p. 411.

Quadrella boopsis granulosa: SAKAI, 1965, pp. 164, 71, fig. 20, pl. 80 fig. 5; SERÈNE, 1968, p. 89.

Quadrella coronata coronata: SERÈNE, 1968, p. 89.

Quadrella granulosa: SERÈNE, 1973, p. 207; 1984, p. 289; SAKAI, 1976, pp. 512, 317, fig. 271, pl. 184 fig. 3; MIYAKE, 1983, p. 140, pl. 47 fig. 6.

Not *Quadrella coronata* var.: NOBILI, 1906a, p. 143; 1906b, p. 294.

Material examined. Suruga Bay, 20 m deep; Nov. 17, 1978; 1 ♀ (NSMT-Cr

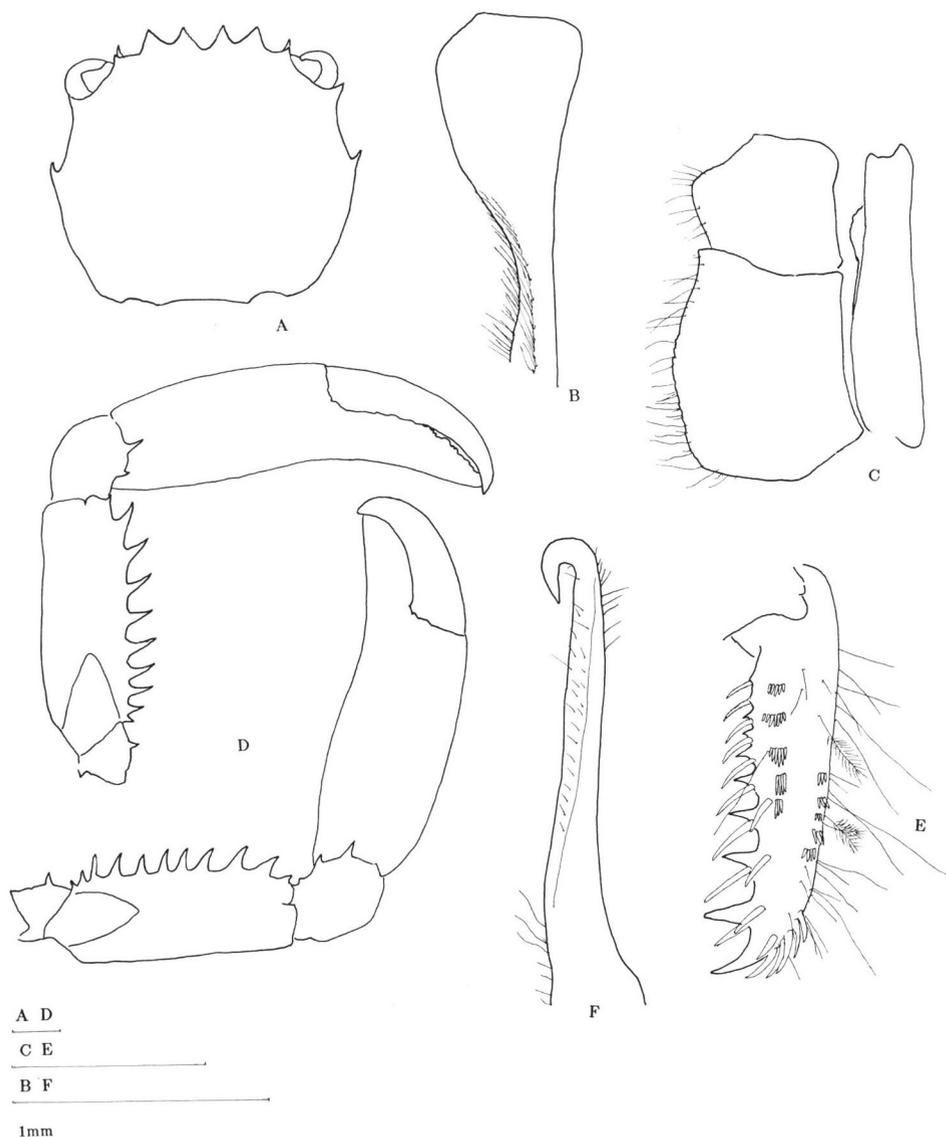


Fig. 2. *Quadrella coronata* DANA. A–D, female from Suruga Bay; E, female from Ogasawara Islands; F, male from Kushimoto. — A, carapace; B, endopod of 1st maxilliped; C, 3rd maxilliped; D, chelipeds; E, 4th ambulatory dactyl; F, 1st pleopod.

8427) from alcyonacean; K. SUZUKI leg. Kushimoto, Kii Penin., 50–70 m deep; Aug. 1979; 2 ♂♂ (NSMT-Cr 6674); S. NAGAI leg. Tatsumi Bay, Chichi-jima I., Ogasawara Is.; 1 ♂, 1 ♀ (NSMT-Cr 9176) from alcyonacean; Y. KURATA leg.

Description. Carapace subhexagonal, convex. Front cut into four triangular

lobes, projects beyond spiniform supraorbital angle. Submedian frontal teeth separated by deep, V-shaped sulcus. Lateral teeth not extending as far forward as submedian pair and separated from latter by shallow, skewed indentation. Superior orbital angle prominent. Postorbital angle spiniform. Inferior orbital angle conical, acute, projecting almost as far forward as lateral frontal teeth. Anterolateral margins sloping to acute, procurved epibranchial spine. Posterolateral margins slightly inflated (Fig. 2A).

Interantennular septum triangulate. Anterior margin of buccal frame sinuous, imperceptibly notched medially. Endognath of first maxilliped paddle-shaped, anterior margin straight (Fig. 2B). Exognath of external maxilliped columnar, tapering distally, obtuse triangular tooth distally on inner margin. Ischium of endognath with posterior margin transverse, anterior internal angle produced, internal margin rounded, prominently tuberculate, setose. Lateral margins of merus subparallel, internal margin setose (Fig. 2C).

Chelipeds well developed, subequal, dissimilarity more pronounced in adult male. Anterior margin of ischium of cheliped with single spine. Merus about 0.8 carapace length, its anterior margin with 7–10 slender, curved spines increasing in size distally. On interior margin of carpus in juveniles two acute spines; posterior spine smaller, tuberculate in adults (Fig. 2D). Chela swollen, 1.3 carapace length, granulate posteriorly.

First ambulatory leg 1.75 times carapace length. Posterior margin of propodi spinose. On posterior margin of fourth ambulatory dactyl eight triangular teeth strongly diminishing in size proximally so that three proximalmost teeth appear as tuberculi. On internal surface six spines distally. Sparse, short rows of spinules scattered on anterior surface. Apical spine strong, curved. Preapically, on anterior margin a cluster of smaller spines (Fig. 2E).

Male pleopod slightly sinuous, setose, tip incurved (Fig. 2F).

Remarks. DANA (1852a: 84) erected *Quadrella coronata* for specimens found in the Sooloo Sea. The characteristic features—neatly spinose merus of cheliped, two spined carpus, tuberculate supraorbital angle and oblique anterolateral margins—are clearly evident in the illustration accompanying the description.

MIERS (1884) described and placed near *Trapezia* a mutilated specimen from Providence Island that in a later footnote (MIERS, 1886) was identified as *Q. coronata*.

Examining specimens from Suvadiva and Mahlos Atolls identified as *Q. coronata* var. *granulosa* by BORRADAILE (1902: 266) we have found them *Q. coronata*.

SAKAI (1965: 164) described Japanese specimens as *Q. boopsis granulosa* even though he recognized that their “Chelipeds are very slender and much longer than seen in the preceding species [*boopsis*], and the teeth along the anterior border of the merus are nine or so. The ambulatory legs are also very slender and proportionally longer than those of *Q. boopsis*.” His drawings, especially that of fourth ambulatory dactyl, are beyond doubt of *Q. coronata*.

SAKAI (1976: 512) wrote: “For identification of the Japanese specimens of this

species [*Q. granulosa*], the author compared with the specimen of *Quadrella coronata* var. *granulosa* deposited in the British Museum. The type of this species is in Cambridge University (SERÈNE), the specimen of the British Museum probably came from Ceylon and identified by LAURIE." Having checked both BORRADAILE's type specimen and the Ceylonese material collected by HERDMAN and identified by LAURIE (1906: 411), we could positively indentify them as *Q. coronata*.

SERÈNE (1968) adopted SAKAI's position. In a later work, however, SERÈNE (1973: 207) recognized the similarity of *Q. granulosa* to *coronata*: "Contrairement à l'opinion de SAKAI (1965), l'espèce est plus voisine de *coronata*, comme le pensait BORRADAILE (1902), que de *boopsis*, dont elle se sépare par les longs meri des chélipèdes, les longues et fines pattes ambulatorires et l'ornementation du bord inférieur des dactyles des péréiopodes 2-5. Pour ce dernier caractère, sur *granulosa* la condition figurée par SAKAI (1965, text-fig. 20b) est presque identique avec celle sur *coronata*."

By NOBILI's account (1906a: 144) his specimens have on their carapace irregular reddish lines; these preclude identification with *Q. coronata*.

Color in life. The Ogasawara Islands specimen shows the entirely semitransparent creamy white. Articulations of the ambulatory legs are yellow. This color pattern is nearly identical with a photograph printed by MIYAKE (1983), differing from the color drawing given by SAKAI (1965; 1976).

Distribution. South Africa, Madagascar, Providence Island, Amirante Island, Seychelles, Maldives, India, Ceylon, Sulu Sea, Philippines, Aru Archipelago, Ceram Island, South China Sea, Japan.

Quadrella maculosa ALCOCK, 1898

Quadrella coronata var. *maculosa* ALCOCK, 1898, p. 226; Illust. Invest. Crust., pl. 38 fig. 2.

Quadrella maculosa: RATHBUN, 1911, p. 235 (part); GUINOT, 1967, p. 275; SERÈNE, 1968, p. 89; 1973, p. 204, figs. 4, 9, 20-22, pl. 3; 1975, p. 513; 1984, p. 288, fig. 194, pl. 41e; GARTH, 1969, p. 188; SERÈNE *et al.*, 1974, p. 24; SAKAI, 1890, pp. 78, 83, fig. 3, frontispiece 2 fig. 3.

Quadrella cyrenae WARD, 1942, p. 45, pl. 3 figs. 5, 6; MICHEL, 1964, p. 30; GUINOT, 1967, p. 275; SERÈNE, 1975, p. 510, figs. 1-4, 13, pl. 1.

Material examined. Seychelles (03°55.0'S, 56°10.0'E); Nov. 27, 1968; 1 ♀, NSMT-Cr 4363; T. V. *Kôyô-Maru* (Shimonoseki Univ. Fish.). Seychelles (04°29.2'S, 56°10.6'E, 63 m deep; Nov. 22, 1968; 1 ♂, 1 ♀, NSMT-Cr 4365; T. V. *Kôyô-Maru*.

Description. Carapace distinctly constricted behind postorbital spines, with convex anterolateral and rounded posterolateral margins. Epibranchial spine prominent, projecting outward. Submedian frontal sulcus wide and shallow, lateral teeth reaching as far forward as submedian pair.

Chelipeds massive. Merus little shorter than carapace, and strongly granulate on anterior margin, with the distalmost tooth largest. Carpus rounded, anterior spine on interior margin prominent, posterior spine appears no more than tubercle in adult. Chela 1.5 carapace length, swollen, tuberculate, tubercles increasing in size

posteriorly, giving posterior margin serrate appearance.

First ambulatory leg more than twice carapace length. Curved cornute spines on posterior margin of propodi. On posterior margin of fourth ambulatory dactyl sixteen triangular teeth, proximally diminishing in size. Interiorly, eight distalmost teeth each with an additional spine. Short irregular rows of spinules anteriorly.

First male pleopod slightly sinuous, subdistally spinose.

Remarks. SAKAI (1980) recorded this species as a symbiont of *Antipathalia* sp. from Kuro-shima Island in the southern Ryukyu Islands. No specimen from Japanese waters is represented in the collections of the National Science Museum, Tokyo.

ALCOCK (1898) described *Q. coronata* var. *maculosa* as having carapace wider than long, chelipeds minutely granulated and anterior border of arm finely denticulate, with two or three spines at distal end.

The original description of *Q. cyrenae* WARD set subsequent authors puzzling over his identification, and SERÈNE (1973) wrote "L'espèce de WARD est très probablement un synonyme de *maculosa*. . . . l'illustration de WARD (1942, pl. 3, figs. 5, 6) montre que le merus du chélipède de *cyrenae* ne diffère en rien de celui de *maculosa*." WARD's description probably was of a young specimen, with the comparatively larger eyes, spinose arm and prominent anterior carpal spine.

Distribution. Madagascar, Amirante Island, Maldives, Andamans, Indonesian waters, Ryukyu Islands.

Quadrella reticulata ALCOCK, 1898

(Fig. 3)

Quadrella coronata var. *reticulata* ALCOCK, 1898, p. 227.

Quadrella reticulata: SERÈNE, 1973, p. 199, figs. 1, 7, 11–13, pl. 1.

? *Quadrella coronata* var.: NOBILI, 1906a, p. 143; 1906b, p. 294.

Material examined. Tanega-shima I., ca. 70 m deep; June 15, 1975; 1 ♀ (NSMT-Cr 5397); M. TAKEDA leg.

Description. Carapace globose, regions poorly marked. Anterolateral margins constricted behind postorbital spine, inflated. Epibranchial tooth well developed, acute. Posterolateral margins rounded. Frontal margin narrower than greatest width of carapace. Submedian frontal lobes separated by rounded sulcus. Lateral lobes wider, less prominent than submedian pair, separated from latter by shallow, skewed indentation. Orbits too shallow to conceal eyes. Superior angles of orbits markedly tuberculate. Postorbital angle conical, acute, directed obliquely outward. Inferior internal orbital tooth spiniform, visible beyond supraorbital angle, extending as far forward as lateral lobe. Orbital margin crescentic (Fig. 3A).

Anterior margin of buccal frame sinuous, minutely notched medially; crests of endostome, defining anterior borders of efferent canals rounded, nicked. Interantennular septum short, subquadrate. Endognath of first maxilliped paddle-shaped, its anterior margin sinuous, antero-interior angle rounded (Fig. 3B). Exognath of ex-

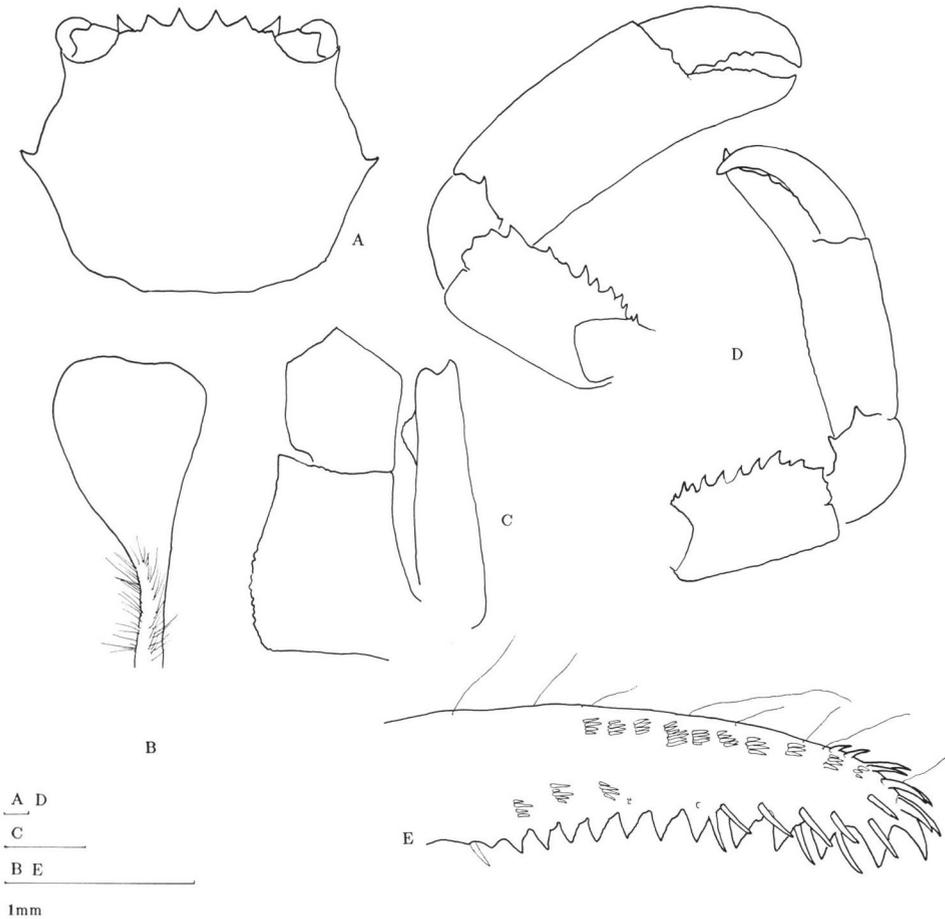


Fig. 3. *Quadrella reticulata* ALCOCK, female from Tanega-shima Island. — A, carapace; B, endopod of 1st maxilliped; C, 3rd maxilliped; D, chelipeds; E, 4th ambulatory dactyl.

ternal maxilliped nearly cylindrical, inner margin slightly scooped distally, bearing triangulate tooth. Inner margin of ischium of endognath produced, wide-angled, proximally tuberculate, setose; merus subpentagonal, inner margin setose (Fig. 3C).

Chelipeds elongate, subequal, granular. Anterior margin of ischium crenate, tuberculate, median tubercle spiniform. Merus about 0.7 carapace length, anterior margin serrate with irregular triangular teeth. Internal angle of carpus with two spines, distal spine larger. Manus 1.3 carapace length, strongly tuberculate, tubercles larger on lower margin (Fig. 3D). Inner margin of ambulatory propodi spinose. First ambulatory leg 1.6 carapace length. On posterior margin of fourth ambulatory dactyl thirteen trianglular teeth, smaller proximally, basally spinose; interiorly above six distalmost teeth cornute spines. Short, irregular rows of spinules on interior and

anterior surfaces (Fig. 3E).

Remarks. *Quadrella reticulata* shares with both *Q. bispinosa* BORRADAILE and *Q. boopsis* ALCOCK a serrulate merus of cheliped. It differs from *Q. bispinosa* in absence of midanterolateral spine, inflated anterolateral margins and number of teeth on posterior margin of dactyl; from *Q. boopsis* it can be distinguished on account of its relatively longer merus and in fresh material, the reticulate design on carapace and chelipeds.

ALCOCK's description (1898) of *Q. coronata* var. *reticulata* is rather brief and offers but three distinctive features: meshwork ornamentation on carapace, serrate anterior margin of merus of cheliped and granulate chelipeds. SERÈNE (1973) elevated it to specific rank and enumerated the distinguishing characters between *Q. reticulata* and *Q. coronata*. NOBILI wrote (1906a: 144): "La carapace . . . est rayée de grosses lignes rouge-pourpre, irrégulières et confluentes." and "Les dactylopodites ont 12–15 denticules spiniformes."; his description however lacks sufficient evidence to verify identification with *Q. reticulata*.

Distribution. Ceylon, Andamans, Singapore, Japan.

Literature

- ALCOCK, A., 1898. Materials for a carcinological fauna of India. No. 3. The Brachyura Cyclo-metopa. Part 1. The family Xanthidae. *J. Asiat. Soc. Bengal*, **67**: 67–233.
- BARNARD, K. H., 1947. Descriptions of new species of South African decapod Crustacea with notes on synonymy and new records. *Ann. Mag. nat. Hist.*, (11), **13**: 361–392.
- 1950. Descriptive catalogue of South African decapod Crustacea. *Ann. S. Afr. Mus.*, **38**: 1–837.
- BORRADAILE, L. A., 1902. Marine crustaceans. III. The Xanthidae and some other crabs. In: J. S. GARDINER (ed.), *The fauna and geography of the Maldive and Laccadive Archipelagoes*, (1): 237–271.
- DANA, J. D., 1851. On the classification of the Cancroidea. *Am. J. Sci. Arts*, (2), **12**: 121–131.
- 1852 a. Conspectus Crustaceorum, quae in Orbis Terrarum circumnavigatione, Carolo WILKES e Classe Ripublicae Foederatae duce, lexit et descripsit. *Proc. Acad. nat. Sci. Philad.*, **6**: 73–86.
- 1852 b. Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles WILKES, U. S. N., **13**: 1–1393. Atlas (1855), pp. 1–27, pls. 1–96.
- ESTAMPADOR, E. P., 1937. A check list of Philippine crustacean decapods. *Philippine J. Sci.*, **62**: 465–559.
- GALIL, B., in press. *Quadrella* (Decapoda, Trapeziidae)—Review and revision. *J. Crust. Biol.*
- GUINOT, D., 1967. La faune carcinologique (Crustacea Brachyura) de l'Océan Indien occidental et de la Mer Rouge. Catalogue, remarques biogéographiques et bibliographie. *Mém. I.F.A.N.*, **77**: 237–352.
- KENSLEY, B., 1981. On the zoogeography of southern African decapod Crustacea, with a distributional checklist of the species. *Smiths. Contr. Zool.*, (338): 1–64.
- KLUNZINGER, C. B., 1913. Die Rundkrabben (Cyclometopa) des Roten Meeres. *Abh. K. Leop.-Carol. Deutsch. Akad. Nat.*, **99**: 97–402, pls. 5–11.
- LAURIE, R. D., 1906. Report on the Brachyura collected by Prof. HERDMANN at Ceylon in 1902.

- Pearl Oysters Fish. Rep.*, 5 (Suppl. Rep. 40): 349–432, pls. 1, 2.
- MIERS, E. J., 1884. Crustacea. In: Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881–2. Part 1. The collections from Melanesia. Part 2. The collections from the Western Indian Ocean. London: 178–322, 513–575, pls. 17–34, 46–52.
- 1886. Report on the Brachyura collected by H.M.S. Challenger during 1873–1876. *Rep. Sci. Res. Voy. H.M.S. Challenger*, Zool., 17(2): i–L, 1–362, pls. 1–29.
- MIYAKE, S., 1983. Japanese Crustacean Decapods and Stomatopods in Color. Vol. 2. Brachyura (Crabs). Osaka, Hoikusha Publ. Co.: i–viii+1–277 pp. (In Japanese.)
- & M. TAKEDA, 1978. Brachyura. In: KIKUCHI, T., & S. MIYAKE (ed.), Fauna and flora of the sea around the Amakusa Marine Biological Laboratory. Part II. Decapod Crustacea. Amakusa Mar. Biol. Lab.: 32–45.
- NOBILI, G., 1906 a. Mission J. BONNIER et Ch. PÉREZ (Golfe Persique 1901). Crustacés décapodes et stomatopodes. *Bull. Sci. Fr. Belg.*, 14: 13–159, pls. 2–7.
- 1906 b. Faune carcinologique de la Mer Rouge. Décapodes et stomatopodes. *Ann. Sci. nat. Zool.*, (9), 4: 1–347, pls. 1–11.
- ORTMANN, A. E., 1897. Die geographische Verbreitung der Dekapodenfamilie Trapeziidae. *Zool. Jahrb., Syst.*, 10: 201–126.
- RATHBUN, M. J., 1911. The Percy Sladen Trust Expedition to the Indian Ocean in 1905. 3 (11). Marine Brachyura. *Trans. Linn. Soc. Lond., Zool.*, 14: 191–261, pls. 15–20.
- SAKAI, T., 1965. The Carbs of Sagami Bay collected by His Majesty the Emperor of Japan. Tokyo, Maruzen Co.: i–xvi+1–206+1–92+1–32 pp., 1–100 pls.
- 1976. Crabs of Japan and Adjacent Seas. Tokyo, Kodansha Co.: i–xxix+1–773+1–461 pp., 1–251 pls.
- 1980. On new or rare crabs taken from Japanese and central Pacific waters. *Res. Crust.*, (10): 73–84, frontispiece, pl. 5.
- SERÈNE, R., 1968. The Brachyura of the Indo-West Pacific region. Prodrômus for a check list of the non-planctonic marine fauna of South East Asia. *Singapore Nat. Acad. Sci., Spec. Publ.*, (1): 33–113.
- 1973. Observations sur les espèces des genres *Quadrella* DANA 1851 et *Sphenomerides* RATHBUN 1898 (Decapoda-Brachyura). *Bull. Soc. zool. Fr.*, 98: 191–209, pls. 1–5.
- 1975. Note additionnelle sur les espèces Indo-Pacifiques de *Quadrella* DANA 1851 (Crustacea, Decapoda, Brachyura). *Ibid.*, 100: 509–521, pls. 1, 2.
- 1984. Crustacés décapodes brachyours de l'Océan Indien occidental et de la Mer Rouge, Xanthoidea: Xanthidae et Trapeziidae. Avec un addendum par CROSNIER, A.: Carpillidae et Menippidae. *Faune Tropicale*, (24): 1–400, pls. 1–48.
- , K. ROMIMOHTARTO & M. K. MOOSA, 1974. The Hippidea and Brachyura collected by the Rumphius Expedition. *Oceanol. Indonesia*, (1): 17–26.
- & C. VADON, 1981. Crustacés Décapodes: Brachyures. List préliminaire, description de formes nouvelles et remarques taxonomiques. In: Res. Camp. MUSORSTOM. *Mém. ORSTOM*, 91: 117–140, pls. 1–4.
- WARD, M., 1942. A new genus and eight new species of Brachyura from Mauritius and the Chagos Archipelago. *Mauritius Inst. Bull.*, (2): 39–48, pls. 2–4.

