

RESEARCH PAPER

Tohru Naruse · Hisao Tamura

## A first record of anchialine crab of the genus *Orcovita* Ng and Tomascik, 1994 (Decapoda: Brachyura: Varunidae) from Japan, with description of the species

Received: March 29, 2005 / Accepted: May 16, 2006 / Published online: August 13, 2006

**Abstract** *Orcovita miruku*, new species, is described from Ishigaki Island, southern Ryukyu Islands, Japan. *Orcovita miruku* is easily distinguished from the other congeners by the presence of three teeth (including external orbital angle) on the anterolateral margin of the carapace. *Orcovita angulata* may be allied to *O. miruku*, but there are a number of differences in the characters of the carapace and the ambulatory legs. The holotype, obtained from an anchialine pool in a limestone excavation, is the only specimen collected thus far, and this is the first record of an anchialine crab from Japan.

**Key words** *Orcovita miruku* · New species · Anchialine crab · Varunidae · Taxonomy · Ryukyu Islands

### Introduction

The Ryukyu Archipelago is located in the subtropical zone of the western Pacific Ocean between Kyushu and Taiwan. Coral-associated limestone areas, together with cave systems, are well developed at many places. As subterranean decapod crustaceans, five species of shrimps, two species of facultative troglodytic crabs, and one species of obligate crab have been recorded from the Ryukyu Islands: *Antecaridina lauensis* (Edmondson, 1935) (Atyidae; see Suzuki, 1980), *Caridina rubella* Fujino and Shokita, 1975 (Atyidae), *Halocaridinides trigonophthalma* (Fujino and Shokita, 1975) (Atyidae), *Macrobrachium miyakoense* Komai and Fujita, 2005 (Palaemonidae), *Metabetaeus minutus* (Whitelegge, 1897) (Alpheidae; see Miya, 1996), *Geothelphusa tenuimanus* (Miyake and Minei, 1965)

(Potamidae; see Naruse, Shokita and Nagai, 2005), *Discoplax rotunda* (Quoy and Gaimard, 1824) (Gecarcinidae; see Shokita and Naruse, 2005), and *Sesarmoides boholano* Ng, 2002 (Sesarmidae; see Naruse, Nakai and Tamura, 2005) (also see Shokita and Nishijima, 1976; Shokita and Ueda, 1977; Shokita, 1979, 1996; Naruse et al., 2003; Yoshigou et al., 2003; Fujita and Shokita, 2005).

Recently, an undescribed species of obligate hypogean crab was discovered from Ishigaki Island, southern Ryukyu Islands, Japan. In the present study, we describe the species and compare it with allied congeners.

### Materials and methods

Specimens are deposited in the Ryukyu University Museum Fужukan (RUMF), Okinawa, Japan and the Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore (ZRC), Singapore. The abbreviations CW, G1, and G2 are used for carapace width, male first gonopod, and male second gonopod, respectively. All characters were measured using a digital slide caliper (Mitsutoyo CD-20PM) to the nearest 0.1 mm.

The holotype of *O. miruku*, new species, was collected from an anchialine pool by a plastic bottle trap baited with cave crickets (unidentified species of *Diestrammena*, Rhabdophoridae), huntsman spiders (unidentified species of *Heteropoda*, Heteropodidae), peanuts, and dried squids.

### Taxonomy

Varunidae

#### *Orcovita* Ng and Tomascik, 1994

#### *Orcovita miruku*, new species

(Figs. 1, 2)

**Material examined.** – Holotype: 1 male, CW 18.4 mm, RUMF-ZC-30, an anchialine pool in a limestone cave (24°34'31.4" N, 124°18'6.8" E), Yoshino, Ishigaki Island, coll. Hozure Nakai, Jan. 22, 2005.

T. Naruse (✉)  
Department of Biological Sciences, National University of  
Singapore, 14 Science Drive 4, Singapore 117543, Singapore  
Tel. +65-6516-2969; Fax +65-6516-2486  
e-mail: naruse@southernx.ne.jp

H. Tamura  
Okinawa Branch, Asian Bat Research Institute, Okinawa, Japan



**Fig. 1.** *Orcovita miruku*, new species. Holotype, RUMF-ZC-33, male, CW 18.4 mm

*Comparative material.* *Orcovita angulata* Ng et al., 1996: 1 female, CW 16.0 mm, ZRC 1996.112, paratype, station 85-56, Raft Cave, Koron Island, Philippines, coll. T.M. Iliffe, Mar. 28, 1985.

*Description of holotype.* – Carapace (Figs. 1, 2a,b) subrectangular, width 1.23 times length, dorsal surface relatively convex (as *Orcovita* species) longitudinally and transversely, dorsal surface smooth, minutely punctate; regions indistinct, epigastric lobe low, H-shaped gastric groove visible; outer half of mesogastric region sloped, a short longitudinal row of granules of urogastric region being a boundary between transverse and sloped surfaces, posterior sidewall to posterior mesogastric regions with pubescences. Front sinuous in dorsal and frontal view, median and near-lateral angle concave posteriorly and ventrally; front narrowly deflexed, frontal margin and deflected part lined with granules, forming vertical narrow plate (Fig. 2b). Supra-orbital margin lined with granules, subparallel to frontal margin, inner angle without slit. Infraorbital margin incomplete, inner half with granulated margin, outer part with vertical and granulated margin connected with external orbital angle, with a short line of granules below disconnected part

of infraorbital margin; suborbital crista lined with distinct granules, inner granules larger; epistome narrow, posterior margin almost straight, with a row of large granules. External orbital angle blunt, almost orthogonal, slightly directed inward; anterolateral margin cristate, with two teeth behind external orbital angle, both teeth blunt, laminar, tip of former tooth closer to that of latter tooth than that of external orbital angle. Posterolateral margin continuous from latter anterolateral tooth, with microscopic granules.

Eye (Fig. 2b) somewhat reduced, subdistal width of cornea being two-thirds of proximal width of peduncle in frontal view.

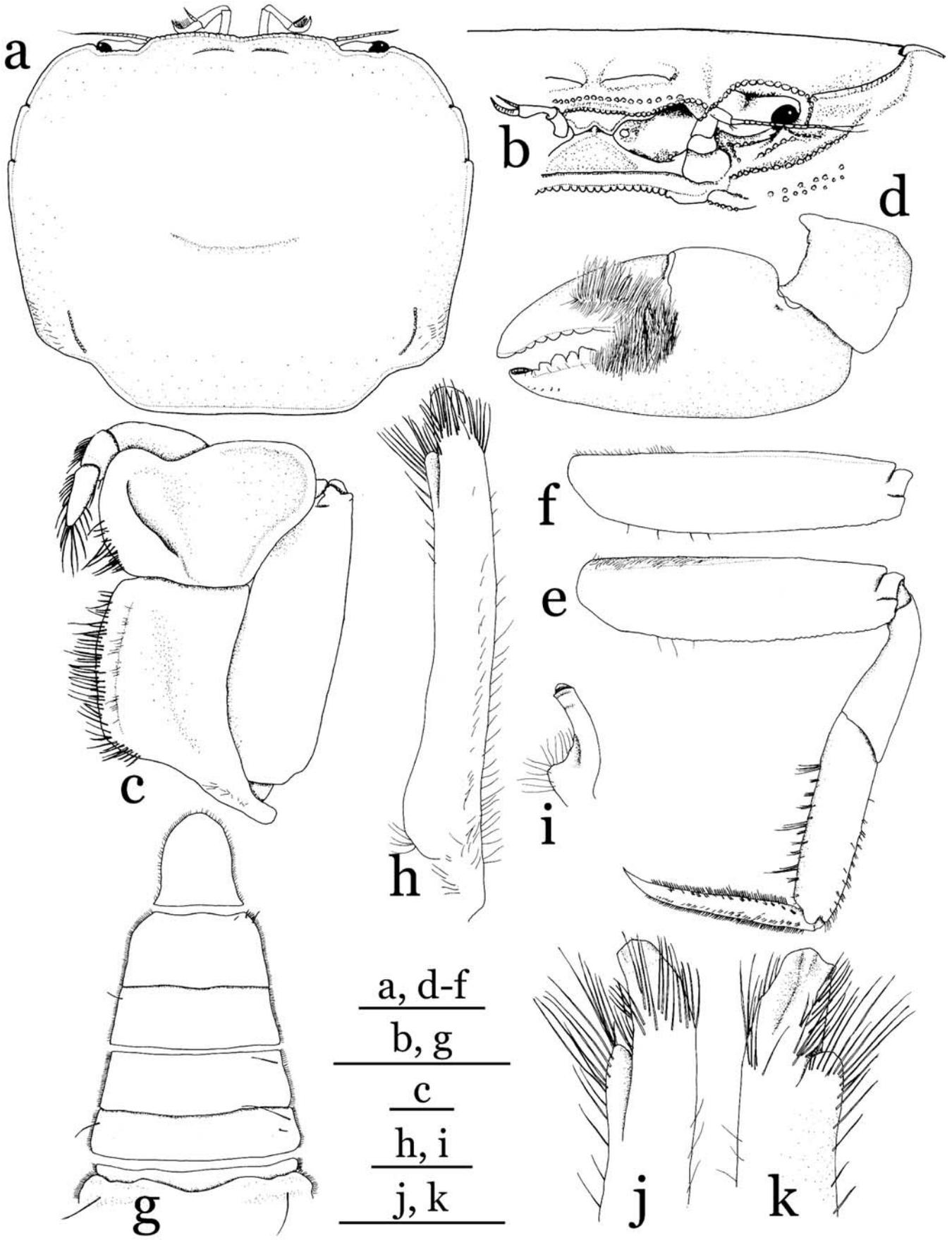
Antennule (Fig. 2b) with developed outer flagellum.

Antenna (Fig. 2b) long, flagellum reaching beyond external orbital angle by its quarter length when stretched laterally.

Third maxilliped (Fig. 2c) stout, leaving median hiatus between inner margins when closed, with black and stiff setae along inner margin; exopod broad, about two-thirds of ischium width, with developed flagellum, reaching beyond inner margin of merus when stretched inward; ischium rectangular, with proximal inner extension; merus wider than

**Fig. 2a–k.** *Orcovita miruku*, new species. Holotype, RUMF-ZC-33, male, CW, 18.4 mm. **a** Carapace, dorsal view; **b** carapace, frontal view (left antenna is not drawn); **c** third maxilliped, left; **d** chela, left; **e** second ambulatory leg, right; **f** third ambulatory leg, right; **g** abdomen

and telson; **h** male first gonopod (G1), ventral inner view, left; **i** male second gonopod (G2), left; **j** distal part of G1, ventral inner view, left; **k** distal part of G1, dorsal outer view, left. Bars **a, b, d–g** 5 mm; **c, h–k** 1 mm



**Table 1.** Comparison between *Orcovita miruku*, new species, and *O. angulata* Ng et al., 1996

	<i>Orcovita miruku</i> , new species	<i>O. angulata</i> Ng et al., 1996
Anterolateral teeth	Three teeth (including external orbital angle)	Two teeth (including external orbital angle) and one angle
Dorsal surface of carapace	Relatively convex	Flat
CW to CL ratio	1.23	1.3, 1.32
Ornamentation of lateral margins	Absent	Granulated
Epigastric crista	Visible	Invisible
Saw-edged margin of ambulatory meri	Anterior ventral margins of 1st and 2nd legs	Anterior ventral margins of all legs and posterior dorsal margin of 1st–3rd meri
Subdistal angle of ambulatory meri	Obtuse angle	Sharp spine
Frontal vertical plate	Low	High
Suborbital crista	Farther from orbit	Closer to orbit
3ML/3MW	4.13	5.38, 5.4
3PL/3PW	3.71	4.23, 5.4
3DL/3DW	9.33	12.59, 16.1
4ML/4MW	6.06	4.40, 4.6
4PL/4PW	2.64	2.94, 3.7
4DL/4DW	6.27	7.26, 6.6
Source	RUMF-ZC-30	ZRC 1996.112, Ng et al., 1996: 129, figs. 2b, 16

CW and CL, carapace width and carapace length, respectively; L, W, M, P, and D, length, width, the ambulatory merus, propodus, and dactylus, respectively; the numbers preceding them refer to the respective ambulatory leg

long, distal external angle auriculate; carpus articulated with middle of anterior margin of merus.

Chelipeds (Fig. 2d) symmetrical, inner margin of ischium to merus serriform; inner angle of carpus with a blunt tooth, fringed with minute teeth, dorsal surface smooth; chela smooth, outer surface with a mat of pubescences from distal median part of manus to proximal third of both fingers, both fingers with inner margin lined with blunt teeth, proximal teeth larger, with horny, hooflike tips, immovable finger with shallow ridge from distal end to middle of manus.

Ambulatory legs (Fig. 2e,f) long, third longest when stretched laterally; merus with pubescences on anterior and posterior margins, black setae on proximal posterior margin, with orthogonal subdistal angle on anterior margin, anterior ventral margin of first and second leg saw-edged, length/width ratios of third and fourth ambulatory propodi 4.13 times and 6.06 times, respectively; propodi with black setae throughout on outer margin on first leg and distal part of outer and inner margins on other legs, length/width ratios of third and fourth ambulatory propodi 3.71 times and 2.64 times, respectively; dactyli with a line of short and dense black setae on outer and inner margins, dorsal and ventral surfaces with two rows of black setae, length/width ratios of third and fourth ambulatory dactyli 9.33 times and 6.27 times, respectively.

Lateral margins of third to sixth abdominal segments (Fig. 2g) straight, subdistal part of sixth segment narrowed, telson bell-shaped.

G1 (Fig. 2h,j,k) simple, slightly curved dorsally, subdistal part of dorsal surface with wide slit, forming lobelike structure, distal part to subdistal lobe with strong setae.

G2 (Fig. 2i) small, length about quarter of G1, distal end bilobed, with almost same width with its middle part.

*Color.* – *Orcovita miruku* has canescent body and appendages.

*Habitat.* – The type locality of *Orcovita miruku*, new species, is a vertical excavation containing an anchialine pool (Holthuis, 1973; Stock, et al., 1986) about 9m below the surface of the ground. The pool appears to be about 1m by 3m, it continues forward under limestone ceilings. Water level seems to be influenced by tidal amplitude.

Samplings were conducted several times, but only one individual of *O. miruku* has been collected thus far (Naruse, unpublished data). From the same pool, *Antecaridina lauensis* (Atyidae) was collected, and *Discoplax rotunda* (Gecarcinidae; RUMF-ZC-527) and *Sesarmoides boholano* (Sesarmidae; RUMF-ZC-402) were also found from the limestone excavation.

*Distribution.* – Known only from Ishigaki Island, Yaeyama Group, southern Ryukyu Islands, Japan.

*Etymology.* – The new species is named after Miruku, a local appellation of Maitreya Bodhisattva for the Yaeyama Group. Among the Ryukyu Islands, Miruku only appears in Yaeyama and some villages of southern part of Okinawa Island. Miruku is credited in Yaeyama Group to be a visiting god and to bring productive grains. The species name is used as a noun in apposition.

## Remarks

*Orcovita miruku*, new species, is easily assigned to *Orcovita* because of the subparallel supraorbital margin against frontal margin, the presence of the vertical plate at the front of the carapace, and the relatively more elongate and slender ambulatory legs (Ng and Tomascik, 1994). Six species of *Orcovita* are known thus far, viz. *O. saltatrix* Ng and Tomascik, 1994 (from Kakaban, Indonesia), *O. gracilipes* Ng et al., 1996 (from Niue), *O. mollitia* Ng et al., 1996 (from Guam), *O. fictilia* Ng et al., 1996 (from Panglao Island,

Bohol, the Philippines), *O. angulata* Ng et al., 1996 (from Koron Island, the Philippines), and *O. mcneiceae* Ng and Ng, 2002 (from Lifou Island, New Caledonia). *Orcovita miruku* remarkably differs from the known *Orcovita* species in possessing two anterolateral teeth behind the external orbital angle, relatively convex dorsal surface, and less broad carapace. *Orcovita angulata* may be allied with *O. miruku* by the shape of the anterolateral margin of the carapace. However, *O. miruku* is easily differentiated from *O. angulata* by the aforementioned characters and the other 11 characters listed in Table 1 (present study; Ng et al., 1996: 129, Figs. 2b, 16).

**Acknowledgments** The authors thank Mr. Hozure Nakai (Kinki University) for providing us with the specimen and two anonymous reviewers for their comments. Thanks are also due to Professor Peter K.L. Ng, Dr. Tan Swee Hee, and Miss Ng Ngan Kee (National University of Singapore) for their help during a visit of the first author, to Professor Shigemitsu Shokita (University of the Ryukyus) for allowing the first author to use the facilities, and to Mr. Takeshi Sasaki (Ryukyu University Museum, Fujukan) for providing us with the information on cave crickets and the huntsman spider. This study was supported by the 21st Century COE program of the University of the Ryukyus.

## References

- Edmondson CH (1935) Atyidae of Southern Polynesia. Occas Pap Bernice P Bishop Mus 11:1–19
- Fujino T, Shokita S (1975) Report on some new atyid shrimps (Crustacea, Decapoda, Caridea) from the Ryukyu Islands. Bull Sci Eng Div U Ryukyus Math Nat Sci 18:93–113
- Fujita Y, Shokita S (2005) *Halocaridinides trigonophthalma* (in Japanese). In: Okinawa Prefectural Government (Nature Conservation Division, Department of Cultural and Environmental Affairs) (ed) Threatened wildlife in Okinawa, 2nd edn (Animals): Red Data Okinawa. Okinawa Prefectural Government (Nature Conservation Division, Department of Cultural and Environmental Affairs), Okinawa, p 194
- Holthuis LB (1973) Caridean shrimps found in land-locked saltwater pools at four Indo-West Pacific localities (Sinai Peninsula, Funafuti atoll, Maui and Hawaii Islands), with the description of one new genus and four new species. Zool Verh 128:1–48, pls 1–7
- Komai T, Fujita Y (2005) A new stygiobiont species of *Macrobrachium* (Crustacea: Decapoda: Caridea: Palaemonidae) from an anchialine cave on Miyako Island, Ryukyu Islands. Zootaxa 1021:13–27
- Miya Y (1996) *Metabetaeus minutus* (in Japanese). In: Japan Fisheries Resource Conservation Association (ed) Basic information on rare wild aquatic animals in Japan (III). Japan Fisheries Resource Conservation Association, Tokyo, pp 417–422
- Miyake S, Minei H (1965) A new fresh-water crab, *Potamon (Geothelphusa) tenuimanus* sp. nov. from Okinawa-jima, the Ryukyu Islands (in Japanese with English summary). Sci Bull Fac Agric Kyushu U 4:377–382, pl 21
- Naruse N, Nakai H, Tamura H (2005) A new record of cavernicolous crab *Sesarmoides bohollano* Ng, 2002 (Brachyura, Sesarmidae) from Ishigaki Island, southern Ryukyu Islands, Japan. Biogeography 7:79–84
- Naruse T, Toda M, Shokita S (2003) A record of *Halocaridinides trigonophthalma* (Atyidae) from Hatoma Island, Yaeyama Group, Southern Ryukyus, Japan (abstract and figure captions in Japanese). Cancer (Tokyo) 12:1–6
- Naruse T, Shokita S, Nagai T (2005) Taxonomy of the terrestrial crab *Geothelphusa tenuimanus* (Crustacea: Decapoda: Brachyura: Potamidae) of Okinawa Island, Central Ryukyus, Japan. Species Divers 10:171–184
- Ng NK, Ng PKL (2002) *Orcovita mcneiceae*, a new species of anchiline crab (Brachyura, Grapsidae, Varunidae) from the Loyalty Islands. Crustaceana 75(5):663–670
- Ng PKL (2002) New species of cavernicolous crabs of the genus *Sesarmoides* from the Western Pacific, with a key to the genus (Crustacea: Decapoda: Brachyura: Sesarmidae). Raffles Bull Zool 50(2):419–435
- Ng PKL, Tomascik T (1994) *Orcovita saltatrix*, a new genus and species of anchialine varunine crab (Crustacea: Decapoda: Brachyura: Grapsidae) from Kakaban Island, Indonesia. Raffles Bull Zool 42(4):937–948
- Ng PKL, Guinot D, Iliffe TM (1996) Revision of the anchialine varunine crabs of the genus *Orcovita* Ng and Tomascik, 1994 (Crustacea: Decapoda: Brachyura: Grapsidae), with descriptions of four new species. Raffles Bull Zool 44(1):109–134
- Quoy JRC, Gaimard JP (1824) Zoologie. In: de Freycinet ML (ed) Voyage autour du monde entrepris par ordre du roi, exécuté sur les corvettes de S.M. L'Uranie et La Physicienne, pendant les années 1817, 1818, 1819 et 1820. Pillet Aîné Paris 3(2):1–712 [not seen]
- Shokita S (1979) The distribution and speciation of the inland water shrimps and prawns from the Ryukyu Islands-II (in Japanese with summary and figure captions). Bull Sci Eng Div U Ryukyus Math Nat Sci 28:193–278
- Shokita S (1996) *Geothelphusa tenuimana*. Japan Fisheries Resource Conservation Association (ed) Basic information on rare wild aquatic animals in Japan (III) (in Japanese). Japan Fisheries Resource Conservation Association, Tokyo, pp 464–466, pl 10
- Shokita S, Naruse N (2005) *Discoplax rotunda*. In: Okinawa Prefectural Government (Nature Conservation Division, Department of Cultural and Environmental Affairs) (ed) Threatened Wildlife in Okinawa, 2nd edn (Animals): Red Data Okinawa (in Japanese). Okinawa Prefectural Government (Nature Conservation Division, Department of Cultural and Environmental Affairs), Okinawa, pp 208–209
- Shokita S, Nishijima S (1976) Aquatic animals of the “Shiokawa Salty Spring,” with a discussion on the flow mechanism of salty water. In: Okinawa Prefectural Board of Education (ed) Survey report on natural monuments of Okinawa Prefecture, 6th series. Survey report on dynamics of the Shiokawa Salty Spring, II (in Japanese). Okinawa Prefectural Board of Education, Okinawa, pp 68–91
- Shokita S, Ueda R (1977) Subterranean water animals of “Shiokawa Salty Spring” and their diurnal and seasonal fluctuations. In: Okinawa Prefectural Board of Education (ed) Survey report on natural monuments of Okinawa Prefecture, 9th series. Survey report on dynamics of the Shiokawa Salty Spring, III (in Japanese). Okinawa Prefectural Board of Education, Okinawa, pp 24–51
- Stock JH, Iliffe TM, Williams D (1986) The concept of “anchialine” reconsidered. Stygologia 2(1/2):90–92
- Suzuki H (1980) An atyid shrimp living in anchialine pool on Kuroshima, the Yaeyama group, Okinawa Prefecture. Proc Jpn Soc Syst Zool 18:47–53
- Whitelegge T (1897) The Crustacea. In: The atoll of Funafuti. Part 2. Mem Aust Mus 3:127–151, pls 6, 7
- Yoshigou H, Tamura H, Iwao M, Izumi R (2003) The cave fauna of Irabu-jima Island, Miyako Group, Ryukyu Islands, Japan (in Japanese). J Hiba Soc Nat Hist 210:1–16, pls I, II