First Records of the Pughead-pipefish

Bulbonaricus davaoensis (Teleostei: Syngnathidae)
from Japan

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Five specimens (41.2–47.0 mm standard length) of the Indo-Pacific species Bulbonaricus davaoensis (Herald, 1953), previously recorded from Kenya, Taiwan, the Philippines, Indonesia, Papua New Guinea, Australia, and Fiji, were collected from Okinoerabu Island, Amami Islands, Ryukyu Islands and Chichi Island, Ogasawara Islands. The specimens represent the first Japanese and northernmost (Okinoerabu Island) records of the species. A detailed description is given for the specimens and the new standard Japanese name “Shuuyajiri-chin’yojiuo” is proposed for the species. Photographs of fresh metamorphosed adult specimens, a fresh larval specimen, and live individuals of B. davaoensis are provided.

Key Words: distribution, Amami Islands, Ryukyu Islands, Ogasawara Islands.

Introduction

The Indo-West Pacific genus Bulbonaricus Herald, 1953 includes three valid species, B. brauni (Dawson and Allen, 1978), B. brucei Dawson, 1984, and B. davaoensis (Herald, 1953) in which B. brauni has been previously recorded from Japan (Suzuki et al. 2002; Senou 2013; Koeda and Fujii 2015). Bulbonaricus davaoensis, originally described as Ichthyocampus davaoensis on the basis of a single non-metamorphosed planktonic specimen from Davao Gulf, Mindanao, Philippines, has been subsequently recorded from scattered localities in the Indo-West Pacific, the northernmost record to date being Taiwan (Ho and Lin 2014).

During an ichthyofaunal survey of Okinoerabu Island, Amami Islands, Ryukyu Archipelago, three metamorphosed adult individuals of B. davaoensis were collected by the Kagoshima University Museum at a depth of 15 m in November 2019. In addition, two metamorphosed adult specimens collected from Chichi Island, Ogasawara Islands in January 2009 were recently found in the fish collection of the Kanagawa Prefectural Museum of Natural History. The combined five specimens, described here, represent the first and northernmost records of B. davaoensis from Japan.

Materials and Methods

Counts and measurements followed Dawson (1977, 1984) and Allen and Erdmann (2008). Measurements were made to the nearest 0.1 mm with needle-point digital calipers under a dissecting microscope. Accurate counts and measurements of two specimens from Chichi Island were not possible due to the damaged tail tip; accordingly “+” was added to the counts and measurements taken. Standard length is abbreviated as SL. Curatorial procedures for the KAUM specimens followed Motomura and Ishikawa (2013). The following description was based solely on the five Japanese specimens. The specimens and underwater photographs examined are deposited at the Kagoshima University Museum, Kagoshima, Japan (KAUM–I. for specimens and KAUM–II. for photographs) and the Kanagawa Prefectural Museum of Natural History, Odawara, Japan (KPM-NI and KPM-NR, respectively). Comparative material of metamorphosed adult B. brauni examined included: KAUM–I. 72147, male, 40.1 mm SL, KAUM–I. 72148, female, 50.4 mm SL, off Atetsu, Setouchi, Amami-oshima Island, Amami Islands, Kagoshima Prefecture, Japan, 28°10’51”N, 129°16’56”E, 15 m depth, T. Fujii, 30 April 2015.

Bulbonaricus davaoensis (Herald, 1953)
[English name: Davao Pughead-pipefish; new standard Japanese name: Shuuyajiri-chin’yojiuo]
(Figs 1–4; Table 1)

Ichthyocampus (Bulbonaricus) davaoensis Herald, 1953: 243, fig. 37 (type locality: Davao Gulf, Mindanao, Philippines).
Enchelyocampus sp.: Dawson 1980: 224, fig. 3 (Taam Island, Banda Sea, Indonesia).
Enchelyocampus brauni (non Dawson and Allen, 1978): Dawson 1980: 225, fig. 4 (off Cape Melville, Cape York Peninsula, Queensland, Australia).

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Bulbonaricus davaoensis: Dawson 1984: 566, figs 1–3 (Ras Iwatine, Mombasa, Kenya; Davao Gulf, Mindanao, Luzon Island, Negros Island, the Philippines; Talisei Island, Ambon Island, Moluccas and Taam Island, Banda Sea, Indonesia; Viti Levu Island, Fiji); Dawson 1985: 27, fig. 47 (Ras Iwatine, Mombasa, Kenya; Davao Gulf, Mindanao, the Philippines; Talisei Island, Ambon Island, Moluccas and Taam Island, Banda Sea, Indonesia; off Cape Melville,
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Cape York Peninsula, Queensland, Australia; Viti Levu Island, Fiji); Paxton and Hanley 1989: 413 (Great Barrier Reef, Queensland, Australia); Randall and Lim 2000: 603 (South China Sea); Allen and Adrim 2003: 27 (Papua New Guinea to Moluccas and North Sulawesi); Paxton *et al*. 2006: 813 (Great Barrier Reef, Queensland, Australia); Kuiter 2009: 290, unnumbered fig. (locality unknown); Allen and Erdmann 2012: 187, unnumbered fig. (off Cape Melville, Cape York Peninsula, Queensland, Australia); Fricke *et al*. 2014: 45 (Madang, Papua New Guinea); Ho and Lin 2014: 26, figs 1–3 (Kenting, Pingtung, Taiwan).

**Material examined.** 5 specimens (2 males and 3 females) from Japan: KAUM–I. 134391, female, 44.6 mm SL, KAUM–I. 134392, male, 41.2 mm SL, KAUM–I. 134393, male, 47.0 mm SL, 187 m off west of Tamina, China, Okinoerabu Island, Amami Islands, Kagoshima Prefecture, 27°22′49″N, 128°31′10″E, 15 m depth, K. Uehara, 16 November 2019; KPM-NI 23063, male, 44.1+ mm SL, KPM-NI 23064, female, 40.9+ mm SL, Futami Bay, Chichi Island, Ogasawara Islands, Tokyo, 27°05′N, 142°11′E, 6 m depth, O. Morishita, 10 January 2009.

**Underwater photographs examined.** All from Japan.

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**Table 1. Counts and measurements of specimens of *Bulbonaricus davaoensis*.**

|                      | This study | Herald (1953) | Dawson (1984) |
|----------------------|------------|---------------|---------------|
|                      | Japan      | Philippines   | Indo-West Pacific |
|                      | Metamorphosed specimens | Non-metamorphosed specimen | Non-metamorphosed specimens | Metamorphosed specimens |
|                      | KAUM–I. 134391 | KAUM–I. 134392 | KAUM–I. 134393 | KPM-NI 23063 | KPM-NI 23064 | Holotype | $n=14^{**}$ | $n=3$ |
| **Standard length**  | 44.6       | 41.2          | 47.0          | 44.1+        | 40.9+        | 33        | 13.0–43.0 | 40–43 |
| **Counts**           |            |               |               |              |              |           |           |
| Trunk rings          | 18         | 16            | 16            | 17           | 17           | 16        | 16–17     |       |
| Tail rings           | 45         | 43            | 45            | 35+          | 32+          | 43        | 40–45     |       |
| Total rings          | 63         | 59            | 61            | 52+          | 49+          | 59        |           |       |
| Pectoral-fin rays    | —          | —             | —             | —            | —            | 11        | 9–13      |       |
| Dorsal-fin rays      | —          | —             | —             | —            | —            | 25        | 22–26     |       |
| Caudal-fin rays      | —*         | 10            | —*            | —            | —            | 10        |           |       |
| Subdorsal rings      | —          | —             | —             | —            | —            | 7.75      | 7.0–8.5   |       |
| **Measurements**     |            |               |               |              |              |           |           |
| Trunk length         | 24.2       | 22.3          | 25.3          | —            | —            | 19.7      |           |       |
| Tail length          | 67.7       | 69.7          | 69.8          | —            | —            | 72.7      |           |       |
| Head length          | 7.2        | 7.0           | 7.0           | —            | —            | 7.6       |           |       |
| Head width           | 2.2        | 2.4           | 2.1           | —            | —            |           |           |       |
| Snout length         | 1.1        | 1.5           | 1.1           | —            | —            | 2.4       |           |       |
| Orbital diameter     | 1.1        | 0.7           | 1.3           | —            | —            |           |           |       |
| Interorbital width   | 0.4        | 0.5           | 0.6           | —            | —            |           |           |       |
| Trunk width          | 2.1        | 1.9           | 1.7           | —            | —            |           |           |       |
| Trunk depth          | 4.0        | 3.6           | 4.0           | —            | —            |           |           |       |
| Anal ring depth      | 3.8        | 2.9           | 3.2           | —            | —            |           |           |       |
| Dorsal-fin base length | —      | —             | —             | —            | —            | 12.7      |           |       |
| Caudal-fin length    | 0.9        | 1.9           | 0.6           | —            | —            | 4.5       |           |       |
| **Measurements**     |            |               |               |              |              |           |           |
| Trunk length (HL)    | 337.5      | 317.2         | 360.6         | 369.7        | 361.8        | —         |           |       |
| Tail length          | 943.8      | 989.7         | 993.9         | —            | —            |           |           |       |
| Head length          | 100.0      | 100.0         | 100.0         | 100.0        | 100.0        | —         |           |       |
| Head width           | 31.3       | 34.5          | 30.3          | 42.4         | 38.2         | —         |           |       |
| Snout length         | 15.6       | 20.7          | 15.2          | 18.2         | 20.6         | —         |           |       |
| Orbital diameter     | 15.6       | 10.3          | 18.2          | 18.2         | 11.8         | —         |           |       |
| Interorbital width   | 6.3        | 6.9           | 9.1           | 9.1          | 11.8         | —         |           |       |
| Trunk width          | 29.7       | 26.9          | 23.9          | 27.3         | 27.6         | —         |           |       |
| Trunk depth          | 56.3       | 51.7          | 57.6          | 54.5         | 58.8         | —         |           |       |
| Anal ring depth      | 53.1       | 41.4          | 45.5          | 48.5         | 55.9         | —         |           |       |
| Caudal-fin length    | 12.5       | 27.6          | 9.1           | —            | —            | —         |           |       |

*Posterior* tip of tail in KPM-NI specimens damaged; *caudal fin* present, but indistinct (poorly developed); **including holotype.*
KPM-NR 97525, Nominoura, Oshima Strait, Kakeroma Island, Amami Islands, Ryukyu Islands, 5 m depth, 24 July 2008, photo by M. Kanazawa; KAUM–II. 83, Tamina, China, Okinoerabu Island, Amami Islands, Ryukyu Islands, 27°22′49″N, 128°31′10″E, 15 m depth, 16 November 2019, K. Uehara; KPM-NR 70435, Kitaya, Okinawa Island, Okinawa Islands, Ryukyu Islands, 7.7 m depth, 11 November 2013, H. Uchino; KPM-NR 92881, Nagura Bay, Ishigaki Island, Kerama Islands, Ryukyu Islands, 7.7 m depth, 11 November 2009, N. Shirakawa; KPM-NR 142824, Zamami Island, Okinawa Islands, Ryukyu Islands, 20 m depth, 11 September 2019, K. Uehara; KPM-NR 70435, Kitaya, Okinawa Island, Okinawa Islands, Ryukyu Islands, 10 m depth, June 2006, Y. Yamada; KPM-NR 97443, Futami Port, Chichi Island, Ogasawara Islands, 7 m depth, 1989, M. Satou; KPM-NR 97444, 97445, 97446, 206006, Futami Port, Chichi Island, Ogasawara Islands, 6 m depth, 5 January 2009, O. Morishita; KPM-NR 97448, Ogasawara Islands, 2009, O. Morishita.

Description. Counts and measurements given in Table 1. Head, including frontal process, illustrated in Fig. 2. Body elongate, slightly compressed. Body ridges smooth. Superior trunk and tail ridges continuous; lateral trunk ridge straight, ending at anal ring; inferior trunk and tail ridges continuous; median ventral trunk ridge indistinct. Head covered with fleshy integument. Snout very short, rounded; mouth inferior; both lips fleshy. Opercle without distinct ridges. Frontal process rounded in cross section, spine-like, smooth on dorsal margin; brood pouch on ventral surface of first to 20th (KPM-NI 230603) or 22nd (KAUM–I. 134392) tail rings in males; pectoral, dorsal, and anal fins absent; caudal fin small in Okinoerabu Island specimens (KAUM–I. 134391–134393), lost in Chichi Island specimens (KPM-NI 230603, 23064) due to damaged tail.

Color when fresh (Fig. 1). Okinoerabu Island specimens: body brownish-red dorsally, white ventrally. Dorsal surface of head greenish-red, with single white V-shaped mark anteriorly. Single deep red margin on ventral and posterior edges of opercle in males; single white line on lateral surface of trunk, spots absent; base of brood pouch reddish-brown. Caudal fin white. Chichi Island specimens: body pale brownish-white dorsally, white ventrally. Base of brood pouch brownish-orange. Single black margin on ventral and posterior edges of opercle in males. Live color illustrated in Fig. 3.

Distribution. Bulbonaricus davaoensis has been recorded from Kenya (Ras Iwatine, Mombasa), Taiwan (Kenting, Pingtung), the Philippines (Davao Gulf, Mindanao), Indonesia (Talisei Island, Ambon Island, Moluccas; Taam Island, Banda Sea; and Liki Island, Irian Jaya), Papua New Guinea (Madang), Australia (off Cape Melville, Cape York Peninsula, Queensland), and Fiji (Viti Levu Island) (Herald 1953; Dawson 1984, 1985; Fricke et al. 2014; Ho and Lin 2014). The species is newly recorded from Okinoerabu Island (Amami Islands, Ryukyu Islands) and Chichi Island (Ogasawara Islands), Japan on the basis of voucher specimens, and Kakeroma Island (Amami Islands), Okinawa Island (Okinawa Islands), Zamami Island (Kerama Islands), and Ishigaki Island (Yaeyama Islands), Ryukyu Islands, Japan on the basis of underwater photographs (this study).

Remarks. Characters of the Japanese specimens agreed well with those of the genus Bulbonaricus defined by Dawson (1984) and Suzuki et al. (2002), in having the following characters: superior trunk and tail ridges confluent; inferior trunk and tail ridges confluent; lateral trunk ridge straight; trunk rings 16–18; total rings 59–63; anal fin absent; caudal-fin rays 10 (in one specimen; counts in remaining specimens not available); head covered with fleshy integument, opercle without distinct ridges, snout short and rounded, mouth inferior, both lips fleshy, and brood pouch on ventral surface of tail in males (KAUM–I. 134392 and KPM-NI 23063). The following characters found in the Japanese specimens were consistent with diagnostic characters of B. davaoensis at the metamorphosed adult stage, given by Dawson (1984): frontal process rounded in cross section, spine-like, with smooth dorsal margin; dorsal, pectoral and anal fins absent; a single white line on lateral surface of trunk; and scattered spots absent on head and body. By comparison, similar stage congeners were characterized by scattered white spots on the head and body (B. brauni) and the frontal process V-shaped, with the dorsal margin spinose or denticate (B. brauni and B. brucei) (Dawson 1984; this study). Although Dawson (1984) described B. davaoensis as having 16 or 17 trunk rings (based on examination of 17 specimens), KAUM–I. 134391 (44.6 mm SL, Okinoerabu Island) had 18 trunk rings.

Live coloration of B. davaoensis has been poorly known to date. Although Allen and Erdmann (2012) stated “live coloration unknown”, Dawson (1984) briefly described two African metamorphosed adult specimens as “pale pink color in smaller specimen and green in larger” (provided from collector). Subsequently, Ho and Lin (2014: figs 1–3) provided photographs of a dark red individual and a newly hatched larva. The present Japanese specimens were reddish (Ryukyu Islands individuals, Fig. 3A) and greenish (Ogasawara Islands individuals, Fig. 3B, C). Because the body sizes and morphology of these specimens were similar, with both sexes included in each color form, it is likely that coloration changes according to individual condition and/or host coral condition or species. Thus coloration differences are unlikely to represent species or population differences, although Dawson (1984) suspected that “more than one taxon may be included in Pacific Ocean material”.

All of the Japanese specimens were collected from cavi-
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Fig. 3. Underwater photographs of *Bulbonaricus davaoensis* from Japan. A: KAUM–II. 83, Okinoerabu Island, Amami Islands, 15 m depth, taken by K. Uehara (photographed individual was collected and registered as either KAUM–I. 134391, 134392, or 134393); B: KPM-NR 97444, Chichi Island, Ogasawara Islands, 6 m depth, taken by O. Morishita; C: same data as B.
ties between polyps of *Galaxea* sp., a colonial stony coral, at depths of 6–15 m (Fig. 3), at least one male and female pair being found per coral. A male from Okinoerabu Island (KAUM–I. 134392, 41.2 mm SL) had nine eggs in the brood pouch at depths of 6–15 m (Fig. 3), at least one male and female in the Amami Islands” project of Kagoshima University and the “Island Research” project of the National Museum of Nature and Science, Tsukuba, Japan; and lower two-thirds of caudal fin black (Fig. 4).

The northernmost record of *B. davaoenensis* has previously been regarded as Kenting, southern Taiwan (Ho and Lin 2014). Accordingly, the present five specimens represent the first records of *B. davaoenensis* from Japan in which the Okinoerabu Island specimens are the northernmost specimen-based record for the species. The new standard Japanese name "Shuuyajiri-chin’yojiuo" is herein proposed for the larval coloration included: body translucent with several brownish vertical bands; two white blotches at dorsal-fin base; and lower two-thirds of caudal fin black (Fig. 4).

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Acknowledgments

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