Bull. Natl. Mus. Nat. Sci., Ser. A, 44(4), pp. 115–123, November 22, 2018

Neolioxantho asterodactylus Garth and Kim, 1983 (Crustacea, Decapoda, Brachyura), a Xanthid Crab New to Japan

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(Received 21 August 2018; accepted 26 September 2018)

Abstract *Neolioxantho asterodactylus* Garth and Kim, 1983, is reported from Kume-jima in the Ryukyu Islands, Hachijo-jima in the Izu Islands, and Hitomaru-jima in the Ogasawara Islands, Japan, as the first record of occurrence since its original description from the Philippines. The species is morphologically distinctive in having the flattened, smooth and poorly areolated dorsal surface of the carapace; four lobes on the anterolateral margin of the carapace; the propodi and dactyli of first three ambulatory legs being square in cross section and having a longitudinal shallow furrow on each surface; and having several chocolate brown or orange rings of variable shapes on the carapace and chelipeds. It is generally close to some species of *Xanthias* Rathbun, 1897, but is considered to be morphologically distinct together with the type species, *N. latifrons* Rathbun, 1911, from Salomon Atoll in the Chagos Archipelago, western Indian Ocean.
Key words: *Neolioxantho*, *Lioxantho*, *Xanthias*, Xanthidae, Ryukyu Islands, Izu Islands, Ogasawara Islands, West Pacific, Japan.

Introduction

During a biodiversity survey for the provision of data for two crustacean guidebooks in Japanese (Kato and Okuno, 2001; Kawamoto and Okuno, 2003), an unfamiliar xanthid crab was collected from the shallow and rocky seafloor off Hachijo-jima in the southern Izu Islands, and Kume-jima in the central Ryukyu Islands. The specimens, which had distinctive color pattern, with chocolate brown rings on the carapace and chelipeds, were then considered to be identical with a crab identified as *Xanthias punctatus* (H. Milne Edwards, 1834) by Nagai and Nomura (1988) from the Ryukyu Islands. However, it was soon observed that their color pattern was quite different from the color photograph of another specimen identified as *X. punctatus* by Sakai (1977; frontispiece fig. 3) from Murotozaki, Kochi Prefecture, Japan, and therefore, they were not identified to the species level in the guidebooks mentioned above. Prior to the above two publications, a xanthid crab having the same color pattern was identified as *X. punctatus* by Minemizu (2000), but, unfortunately, the specimen was not collected. Recently, an ovigerous female of the same species was obtained at Hitomaru-jima in the Ogasawara Islands during the SCUBA survey by the third author of the present paper.

Following the kind suggestion of Dr. J. C. E. Mendoza of the Lee Kong Chian Natural History Museum, National University of Singapore, and also by reference to the genus *Xanthias* Rathbun, 1897, and some related genera, the above specimens were proved to be different from *X. punctatus*, but were identified instead as *Neolioxantho asterodactylus* Garth and Kim, 1983, a species

previously known only from the Philippines. The genus *Neolioxantho* was established by Garth and Kim (1983) to accommodate two species, *Lioxantho latifrons* Rathbun, 1911, from the Chagos Archipelago in the western Indian Ocean and a new species, *N. asterodactylus*, from Jolo Island in the Sulu Archipelago, the Philippines. There is no subsequent record of new material nor any subsequent study on the specific or generic validity of both species. The present record of occurrence of *N. asterodactylus* in Japanese waters is, therefore, important for the biogeographical extension of this species and also for the discussion of the systematic relationship of *Neolioxantho* and *Xanthias*.

The specimens examined are preserved in the Tsukuba Research Departments, the National Museum of Nature and Science, Tokyo (NSMT) and the Natural History Museum and Institute, Chiba (CMNH). In the following description, the breadth and length of the carapace are abbreviated as cb and cl., and the suffix "jima" means "island" in Japanese.

Family X a n t h i d a e

Genus ***Neolioxantho*** Garth and Kim, 1983

[New Japanese name: Wamon-gani zoku]

Neolioxantho asterodactylus

Garth and Kim, 1983

[New Japanese name: Wamon-gani]

(Figs. 1–4)

Xanthias punctatus: Nagai and Nomura, 1988, p. 164, 1 color photograph; Minemizu, 2000, p. 262, 1 color photograph. (Not *X. punctatus* (H. Milne Edwards, 1834))

Xanthias sp.: Kato and Okuno, 2001, p. 127, 1 color photograph; Kawamoto and Okuno, 2003, p. 130, 1 color photograph.

Material examined. Shichu-gama, Kume-jima, Ryukyu Is., 8 m deep, 1 ♂ (cb 11.4 × cl 7.5 mm), CMNH–ZC 01190, June 2, 2002, T. Kawamoto leg.; Same locality and depth, 1 ♂ (cb 7.7 × cl 5.2 mm), NSMT–Cr 26839, July 29, 2002, T. Kawamoto leg.

Sokodo, Hachijo-jima, Izu Is., 15 m deep, under stone, 1 ♂ (cb 11.3 × cl 7.5 mm), NSMT–Cr 26840, Nov. 1, 2000, S. Kato leg.; Same locality, 10 m deep, 1 ♂ (cb 8.1 × cl 5.4 mm), CMNH–ZC 02557, Sept. 2, 2000, J. Okuno leg.

Hitomaru-jima, Ogasawara Is., 27°07′04″N, 142°11′27″E, 6–8 m deep, 1 ovig. ♀ (cb 8.3 × cl 5.5 mm), NSMT–Cr 26841, July 29, 2014, H. Komatsu leg.

Description. Small species (cb 10.1 × cl 6.2 mm in holotype from the Philippines, cb 7.7 × cl 5.2 mm—cb 11.4 × cl 7.5 mm in five specimens from Japanese waters). Outline of carapace transversely elliptical, width 1.48–1.52 (av. 1.50 in 4 males and 1 ovigerous female) times length (Figs. 2A, 3C, 4A); dorsal surface of carapace nearly flat laterally (Fig. 3A), weakly deflexed downwards for its anterior half (Fig. 3B), smooth and polished (Figs. 2A, 4A) to the naked eye without granules, setae and interregional furrows; under magnification, anterolateral marginal and postorbital regions weakly roughened with more or less symmetrically arranged shallow depressions (Fig. 3C). Front as wide as true posterior margin of carapace, nearly transverse in dorsal view (Figs. 2A, 3C, 4A), divided into two weakly convex lobes, with small, but distinct, median notch, more visible in frontal view (Fig. 3B); each frontal lobe continuous with obtuse supraorbital angle without depression (Figs. 3B, 4A). Orbit (Figs. 3B, C, 4A) as wide as each frontal lobe, deeply concave dorsally; supraorbital margin narrowly raised throughout, isolated from carapace dorsal surface by shallow, narrow marginal furrow; external orbital angle raised as terminal part of supraorbital margin, but not produced as a tooth.

Anterolateral margin of carapace (Figs. 2A, 3C, 4A) convex, divided into four obscure lobes behind external orbital angle; first lobe separated from external orbital angle by a small concavity, feebly isolated from, or nearly confluent with, second lobe; first and second lobes together weakly arched, occupying nearly half of anterolateral margin; second lobe as wide as first lobe, with thick outer margin demarcated by eroded marginal depression; third lobe prominent, dis-

Fig. 1. *Neolioxantho asterodactylus* Garth and Kim, color in life. A, male (CMNH–ZC 02557; cb 8.1 × cl 5.4 mm) from Hachijo-jima, Izu Is.; B, male (NSMT–Cr 26839; cb 7.7 × cl 5.2 mm) from Kume-jima. Ryukyu Is.; C, male (CMNH–ZC 01190; cb 11.4 × cl 7.5 mm) from Kume-jima; D, ovigerous female (NSMT–Cr 26841; cb 8.3 × cl 5.5 mm) from Hitomaru-jima, Ogasawara Is.

tinctly isolated from second lobe, with nearly longitudinal outer margin and obtuse anterior angle; fourth lobe separated from third lobe by a notch, with lateral margin completely confluent with posterolateral margin of carapace; posterolateral margin of carapace nearly straight or only weakly convex together with outer margin of fourth lobe, converging posteriorly toward lateral end of posterior margin of carapace.

Third maxilliped (Fig. 4F) smooth, without granules and hairs on ventral surface; merus quadrate, with concave outer margin and subacute anterolateral angle; ischium about twice as large as merus, with cristate mesial margin lined with submarginal setae; palp stout, subcylindrical, tapering rapidly; exopod stout, about half as wide as ischium.

Male pleon (Fig. 2B) narrow, five-segmented (including telson), with completely fused third to fifth somites; sixth somite and telson together as long as fused three somites, each lateral margin of sixth somite weakly concave; telson subacute along distal margin (Fig. 4G).

In both sexes, both chelipeds (Figs. 2, 3A, B) subequal in size and shape, smooth without any granules, not elongated. Merus short, mostly hidden under epimeral surface of carapace, its whole inner surface flattened or shallowly concave; upper margin of merus rather thin along proximal half, blunt along distal half; a thick, blunt, more or less compressed tooth at median part of upper margin of merus. Carpus (Figs. 2A, 4B) prominent in size, as large as merus, completely smooth without granules and depressions, inner angle subtruncated. Palm (Figs. 2A, B, 3A, B, 4B) inflated, with a shallow longitudinal furrow

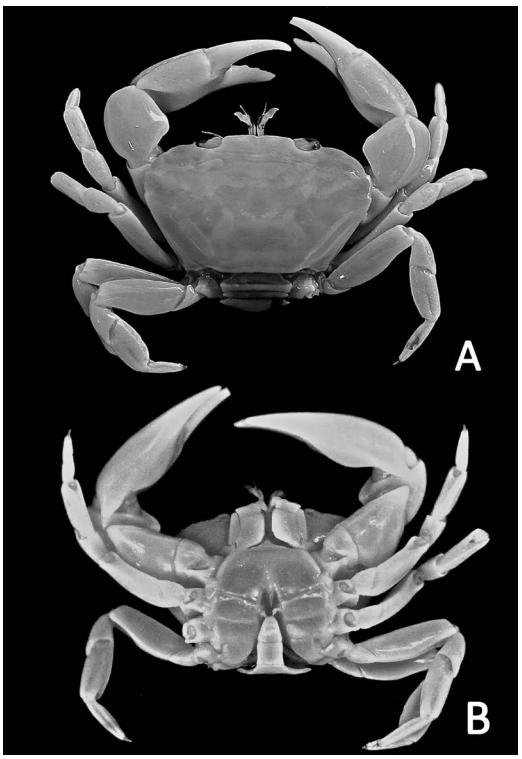

Fig. 2. *Neolioxantho asterodactylus* Garth and Kim, male (NSMT–Cr 26840; cb 11.3×cl 7.5 mm) from Hachijo-jima, Izu Is. A, B, dorsal and ventral views, respectively.

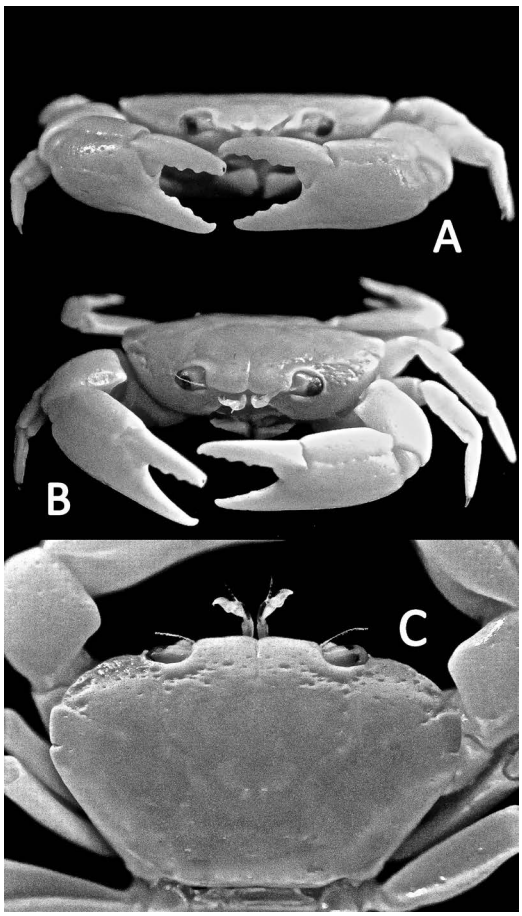

Fig. 3. *Neolioxantho asterodactylus* Garth and Kim, male (NSMT–Cr 26840; cb 11.3×cl 7.5 mm) from Hachijo-jima, Izu Is. A–C, different views, showing the chela, front–orbital area, and contour and dorsal surface of the carapace.

at outer upper surface close to upper margin. Fingers (Figs. 2A, B, 3A, B) subequal in length to palm, toothed throughout cutting edges, leaving no space between both fingers.

Ambulatory legs (Fig. 2) comparatively stout, glabrous. Each merus depressed, lower surface wholly flattened or rather concave, anterior margin more less thin-edged. Each carpus smooth, rather inflated dorsally; carpus and propodus subequal, their combined length as long as merus. Each propodus and dactylus of first three pairs stout, thick, rectangular in cross section, with pole-like appearance having four flat surfaces (Fig. 4C–E); each of four surfaces with a longitudinal furrow; furrows not deeply and sharply cut, but distinctly deep to make edges of square pole. Each dactylus armed with some microscopic tubercles at lower surface just close to terminal horny claw.

Male first pleopod (Fig. 4H, I) well developed, compressed, narrowing distally; long feathered hairs arranged along inner part of terminal part, conical horny tubercles at outer part of terminal part. Second pleopod short, one fourth as long as first, with a long, weakly curved tip.

Color in life. All the specimens preserved in 70% ethyl alcohol are creamy white, but the color in life is shown in Fig. 1 (A, B: 2 ♂♂, CMNH–ZC 02557 and NSMT–Cr 26839／C: 1 ♂, CMNH–ZC 01190／D:1 ovig. ♀, NSMT–Cr 26841). The dorsal surface of the carapace is ornamented with many chocolate brown rings that are irregular in shape and size and some-

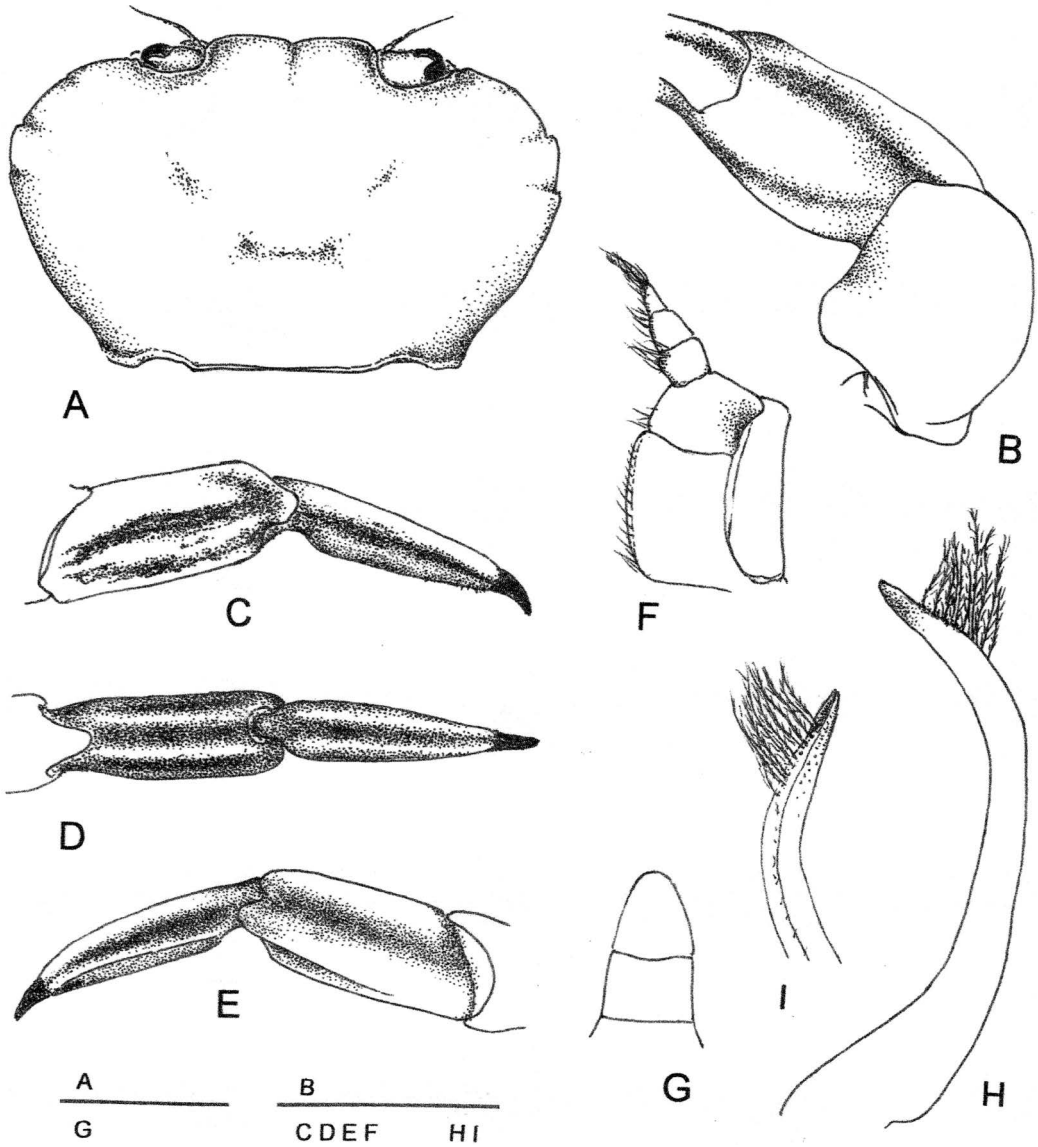

Fig. 4. *Neolioxantho asterodactylus* Garth and Kim, male (NSMT–Cr 26840; cb 11.3 × cl 7.5 mm) from Hachijo-jima, Izu Is. A, carapace; B, carpus and palm of right cheliped in dorsal view; C–E, propodus and dactylus of right third ambulatory leg in dorsal (C), anterior (D), and ventral (E) views; F, left third maxilliped; G, last two abdominal segments; H, I, left first pleopod in sternal (H) and ventral (I) views. Scale for A = 3 mm; G = 1 mm. Scale for B = 2 mm; C, D, E, F = 4 mm; H, I = 0.5 mm.

times united together, but basically arranged symmetrically. The color of the cheliped merus, carpus and palm are lighter than the basic color of the carapace, having also the dispersed rings. The ambulatory legs are whitish, and each merus is provided with two chocolate brown bands at the median and subdistal parts. Each of the carpi, propodi and dactyli is chocolate brown for the basal half.

Remarks. The present specimens (four males and one ovigerous female from Japan) morphologically agree well with the original description and figures of a male (holotype) from Jolo Island in the Sulu Archipelago, the Philippines, and

there is no space to doubt the specific identification. It is therefore definitely said that the distinctive color pattern (Fig. 1) is characteristic for *Neolioxantho asterodactylus*. In the specimen from Kume-jima reported by Minemizu (2000: 262, 1 unnumbered fig.), the color pattern is basically same with those of the other specimens, but more complex, with many variable shape of lings on the dorsal surface of the carapace.

According to the original description (Garth and Kim, 1983), *N. asterodactylus* differs from the type species, *N. latifrons* (Rathbun, 1911), in 1) the regions of the carapace being well indicated (vs. obscure), 2) the cheliped merus being without a subterminal tooth (vs. with a subterminal tooth), 3) the movable finger being longer than the upper margin of the palm (vs. subequal), and 4) each carpus of the first three ambulatory legs being armed with a blunt terminal tooth on the anterior margin (vs. unarmed).

Apart from the discrimination of two species of the genus *Neolioxantho* Garth and Kim, 1983, its generic validity and distinction from the genus *Xanthias* Rathbun, 1897, replacement name for the genus *Xanthodes* Dana, 1852, preoccupied by a lepidopteran insect, should be discussed more.

Garth and Kim (1983) briefly summarized the complex circumstances of establishing a new genus *Neolioxantho* for two species, *Lioxantho latifrons* Rathbun, 1911, from the Chagos Archipelago and a new close relative from the Philippines. The genus *Lioxantho* Alcock, 1898, was established to accommodate three species, *Xantho punctatus* H. Milne Edwards, 1834, *L. tumidus* Alcock, 1898, and *L. asperatus* Alcock, 1898, without type designation, and the fourth species, *L. latifrons* was described by Rathbun (1911), with the comments of "not a typical *Lioxantho*, because the front-orbital breadth is more than half as great as width of carapace." Later, however, Odhner (1925) transferred *L. punctatus* to *Xanthias*, and Balss (1938) and Guinot (1964, 1968) noted that *L. asperatus* and *L. tumidus* are synonyms of *Xanthias sinensis* (A. Milne–Edwards, 1867) and *Lachnopodus subacutus* (Stimpson, 1858), respectively. The generic and specific statuses of *Lioxantho latifrons* have not been mentioned anywhere, and Takeda (1976) proposed a replacement name, *X. rathbunae*, for *Lioxantho latifrons* Rathbun nec *Xanthias latifrons* (De Man, 1887), on the opinion that *Lioxantho latifrons* is not a *Lachnopodus* species, but a *Xanthias* species.

As noted above, Garth and Kim (1983) proposed a new genus, *Neolioxantho*, to accommodate *Lioxantho latifrons* Rathbun and a new species, *N. asterodactylus*. The original authors discussed the relation of *Neolioxantho* to the genus *Lachnopodus* Stimpson, 1858, but the comparison with *Xanthias* was not made. The generic morphological differences of *Neolioxantho* from *Lachnopodus* are apparent in the front-orbital formation and the armature and hairiness of the ambulatory legs, but the diagnoses of *Neolioxantho* enumerated in the original definition seem to be general and rather unclear for the distinction from *Xanthias*.

The genus *Xanthias* is currently represented by 14 Indo-West Pacific and 1 West Atlantic species. They are seemingly not always homogeneous, with different appearance of the carapace—i.e. smooth, granulated, setose, deeply areolated or ill—defined dorsal surface of the carapace. The male first pleopod is provided with feathered long hairs at distal to subdistal part in the Indo-West Pacific species except for *X. teres* Davie, 1997 (from off Loyalty Island, 282 m deep). The West Atlantic species, *X. inornatus*, is possibly classified into the different genus from the Indo-West Pacific *Xanthias*, as Števčić (2005) proposed a new genus, *Pestoxanthus*, for it. However, according to Ng *et al.* (2008), the name is nomenclaturally unavailable, because the genus name was proposed without diagnosis. Even if the generic distinction between the Indo-West Pacific and West Atlantic species is justified, the name will need to be formally diagnosed.

Lai *et al.* (2011) who studied the phylogeny of the family Xanthidae with multi-gene analysis indicated that the genus *Xanthias* is apparently polyphyletic. The representative species used for

the analysis were *X. lamarckii* (H. Milne Edwards, 1834) (type species), *X. punctatus*, *X. latifrons* (De Man, 1887), *X. canaliculatus* (Rathbun, 1906) and *X. teres*. The results (Lai *et al.*, 2011: 420–421, fig. 1) showed that *X. lamarckii*, *X. punctatus* and *X. canaliculatus* are associated with a zosimine clade, *X. latifrons* is sister to an actaeine + liomerine + xanthine clade, and *X. teres* is nested within an euxanthine clade. Mendoza (2013), who fully understood the polyphyletic condition of *Xanthias*, suggested that some species should be transferred to the other genera. He, however, deferred from making any formal taxonomic actions at the time and simply described a new species, *X. joanneae*, from the Philippines, which is closely related to *X. maculatus* Sakai, 1962, from Japan, both species being retained in *Xanthias sensu lato*.

In the original description of *Lioxantho latifrons* which was designated as the type species of the new genus, *Neolioxantho*, by Garth and Kim (1983), Rathbun (1911, p. 213) remarked as follows: "This species is very much like *L. punctatus* Milne Edwards, from which it is distinguished at a glance by the greater width across front and orbits; the carapace is also smoother and more shining." Consulting all the *Xanthias* species, *X. punctatus* (H. Milne Edwards, 1834) seems to be most close to *Neolioxantho latifrons* and *N. asterodactylus*, in having the smooth carapace, chelipeds and ambulatory legs (A. Milne–Edwards, 1873, pl. 7 fig. 6; Serène, 1984, pl. 27 fig. E; Sakai, 1977, frontispiece fig. 3 in color), but differs from both species of *Neolioxantho* in the characters that the carapace is definitely elliptical, with the strongly convex anterolateral and posterolateral margins of the carapace, and that the gastric regions in the carapace dorsal surface are distinctly demarcated by wide shallow furrows. Six syntype specimens (4 ♂♂ and 2 ♀♀ from Île de France, MNHN 2991, 2992, 2994–2996) of *Xanho punctatus* preserved in the Muséum national d'Histoire naturelle, Paris, were examined by the first author through the courtesy of Dr. D. Guinot. All the specimens are dry, but kept in good condition, retaining blue, not brick red, color spots on the carapace. Otherwise, the following specimens identified as *Xanthias punctatus* were examined.—MNHN B6654, 3 ♂♂, 1 ♀, 1 ovig. ♀, 1 ♀ (dry), Nosy Be, Madagascar, A. Crosnier coll., R. Serène det.; B6655, 1 ♀, Madagascar, A. J. Bruce coll., R. Serène det.; B6656, 1 ♀, Port Dauphin, Madagascar, R. Serène det.; B9760, 1 ♂, Nhatrang, R. Serène coll. & det.; B13238, 1 ♂, Tahiti, J. Forest & D. Guinot det.; B13284, 1 ♂, 1 ♀, Île Maurice, E. L. Bouvier det.; B13285, 1 ♀, Samoa; B13635, 2 ♂♂, 1 ♀, Djibouti, M. Jousseaume coll., G. Nobili det. as *Lioxantho punctatus*; B13636, 1 ♂, Madagascar, H. Balss det.; B13637, 4 exs (fragments), no data, H. Balss det.; B13638, 1 ♀, Nosy Be, Madagascar, H. Balss det.; B13639, 1 ♀, no data; B13641, 1 ♀, no data, H. Balss det.; B13642, 1 ♂, Mer Rouge, M. Jousseaume coll., G. Nobili det. as *L. punctatus*; B26128, 2 ♀♀, Madagascar, H. Balss det.

Neolioxantho asterodactylus is specifically distinguished from all the *Xanthias* species in having the depressed and smooth carapace, four blunt lobes behind the external orbital angle and the pole-like propodi and dactyli of the anterior three ambulatory legs, and probably distinguished at the generic state from the *Xanthias* species by the combination of the above characters. At present, as the molecular analysis is not made, *Neolioxantho* is dealt with as valid and distinct from *Xanthias* for the time being.

Distribution. This species has been originally reported from Jolo Island in the Sulu Archipelago, the Philippines, 27 m deep, and now recorded from southern and southwestern Japan: Kume-jima in the Ryukyu Islands, 8 m deep; Sokodo, Hachijo-jima in the Izu Islands, 10–15 m deep; Hitomaru-jima in the Ogasawara Islands, 6–8 m deep.

Acknowledgements

We thank Mr. Shoichi Kato of the *Regulus Diving*, Hachijo-jima in the Izu Islands, and Mr. Tsuyoshi Kawamoto of the *Dive Estivant*, Kume-jima in the Ryukyu Islands, for donating us the

specimens dealt with in this paper. The comments on the systematic relation of *Xanthias* and *Neolioxantho* from Dr. J. C. E. Mendoza of the Lee Kong Chian Natural History Museum, Singapore, are deeply acknowledged. The first author thanks Dr. D. Guinot of the Muséum national d'Histoire naturelle, Paris, who was kind enough to give him the chance to examine the *Xanthias* collections under her care. This work is a contribution from the two projects "Biological Properties of Biodiversity Hotspots in Japan" (2013–8) and "Geological, biological, and anthropological histories in relation to the Kuroshio Current" (2016–), conducted by the National Museum of Nature and Science, Tokyo. This work was partly supported by JSPS KAKENHI grant number JP25840147 for the third author.

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