

Redescription of the fish parasite *Nerocila japonica* Schioedte & Meinert, 1881 (Crustacea: Isopoda: Cymothoidae), with comments on previous records of *N. acuminata* in Japanese waters

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Abstract *Nerocila japonica* Schioedte & Meinert, 1881 is redescribed based on the holotype and specimens from various localities in Japanese waters. The following fishes are recorded as new hosts: *Tribolodon hakonensis* (Cyprinidae), *Mugil cephalus*, *Liza affinis*, *Chelon haematocheilus* (Mugilidae), *Lateolabrax japonicus*, *L. latus* (Lateolabracidae), *Acanthopagrus latus*, *A. schlegelii schlegelii* (Sparidae), *Rhyncope-lates oxyrhynchus* (Terapontidae), *Ditrema viride*, *D. temminckii temminckii* (Embiotocidae), *Chaenogobius gulosus*, *Acanthogobius flavimanus* (Gobiidae), *Pseudolabrus* sp. (Labridae) and *Aluterus monoceros* (Monacanthidae). Specimens previously recorded as ‘*Nerocila acuminata*’ from Toyama Bay (the Sea of Japan) were examined, when available, and re-identified as *N. japonica*. As there has been no reliable record of *N. acuminata* Schioedte & Meinert, 1881 from off Japan, reports of this species in Japanese waters are considered to represent *N. japonica*.

Introduction

Nerocila Leach, 1818 is a genus of cymothoid isopod with almost all of its members occurring as the body

surface parasites of fishes (Bruce, 1987). This genus comprises 43 species (Bruce & Schotte, 2009), three of which are known from off Japan (Saito et al., 2000): *N. acuminata* Schioedte & Meinert, 1881, *N. japonica* Schioedte & Meinert, 1881 and *N. phaiopleura* Bleeker, 1857. Of these, *N. acuminata* and *N. japonica* belong to the ‘*Nerocila orbignyi* species-group’ (Bruce, 1987).

Nerocila acuminata is known as an East Pacific and Caribbean species (Brusca, 1981). However, it has been recorded from Japanese waters (Iwasa, 1947; Shiino, 1965; Honma et al., 1974; Nunomura, 1981, 1985). Bruce (1987) suspected that *N. acuminata*, as reported by Nunomura (1981), might actually represent *N. japonica*.

Nerocila japonica was originally described on the basis of a non-ovigerous female collected from “mare Iaponico” (= Japanese waters) (Schioedte & Meinert, 1881). Since then, *N. japonica* has been mentioned in the literature several times (Thielemann, 1910; Nierstrasz, 1918, 1931; Gurjanova, 1936; Bruce, 1987). Recently, additional specimens of this species were reported by Yu & Li (2003) from Chinese waters and by Hashimoto (2007) from Pacific waters off Kochi Prefecture, Shikoku, Japan. However, limited information has so far been available on *N. japonica*.

In this study, we redescribe *N. japonica* based on the holotype and specimens from various localities in Japanese waters. We also discuss the previous records of *N. acuminata* from off Japan.

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Materials and methods

Specimens were preserved in 70% ethanol or 10% formalin. Appendages were dissected from the isopods with needles. Photographs were made with a digital camera and drawings were made with the aid of drawing tubes attached to microscopes (Nikon SMZ800 and Nikon ECLIPSE 80i).

The isopod classification used follows Brandt & Poore (2003). The common and scientific names of fishes follow those recommended by Froese & Pauly (2009). Those specimens examined are deposited in the following museums: Swedish Museum of Natural History, Stockholm (SMNH), Toyama Science Museum, Toyama (TOYA), Himeji City Aquarium, Himeji (HCA), Osaka Museum of Natural History, Osaka (OMNH), and Kitakyushu Museum of Natural History and Human History, Kitakyushu (KMNH).

Suborder Cymothoidea Wägele, 1989

Family Cymothoidae Leach 1814

Genus *Nerocila* Leach, 1818

Nerocila japonica Schioedte & Meinert, 1881

Syns *Nerocila acuminata* of Nunomura (1985), Saito et al. (2000), possibly Honma et al. (1974), possibly Nunomura (1981) [nec *N. acuminata* Schioedte & Meinert, 1881]

Type-material: Holotype: 1 non-ovigerous female (19.5 mm), Japan, coll. R. M. Salmin (SMNH Type-8206 = NRM 4975).

Material examined: [Sea of Japan] 1 non-ovig. female (21.5 mm), on pectoral fin of *Mugil cephalus* Linnaeus, Uozu Aquarium, Uozu, Toyama, 4 Dec. 1979, coll. Y. Kano (TOYA-Cr 23229); 1 ovig. female (19.0 mm), 1 male (16.0 mm), on pectoral and caudal fins of *M. cephalus*, Uozu, Toyama, 4 Dec. 1974, coll. Y. Kano (TOYA-Cr 23230, 23231); 1 male (19.5 mm), on pectoral fin of *Acanthopagrus schlegelii schlegelii* (Bleeker), Uozu, Toyama, 2 Jun. 1977, coll. Y. Kano (TOYA-Cr 23232); 1 ovig. female (21.0 mm), on body surface of *Ditrema temminckii temminckii* Bleeker, off Namerikawa, Toyama, 18 Jul. 1974, coll. Y. Kano (TOYA-Cr 23233); 1 ovig. female (18.5 mm), on caudal fin of *D. t. temminckii*, Uozu South Port, Uozu, Toyama, 1 Oct. 1975, coll. Y. Kano (TOYA-Cr 23234); 1 non-ovig. female (23.0 mm), on pectoral fin of *Pseudolabrus* sp. [*P. eoethinus*

(Richardson) or *P. sieboldi* Mabuchi & Nakabo] (22.0 cm total length [TL]), Uozu South Port, Uozu, Toyama, 24 Aug. 2001, coll. Y. Kano (TOYA-Cr 23235); 2 non-ovig. females (19.0, 22.5 mm), 3 males (15.0, 18.0, 19.0 mm), 1 aegathoid (9.5 mm) from body surface of *Tribolodon hakonensis* (Günther), 10 Mar. 2003, off Ômizaki, Lake Nakaumi, Shimane, coll. K. Yamaguchi et al. (TOYA-Cr 23236–23241); [Seto Inland Sea] 4 ovig. females (25.0, 25.0, 26.0, 29.0 mm), ex. *Mugil cephalus*, Dejima, Sakai, Osaka, Jun. 1978, coll. Y. Nabeshima (OMNH Ar6599); 1 non-ovig. female (22.5 mm), from mouth cavity of *Lateolabrax japonicus* (Cuvier & Valenciennes), off Sakai, Osaka Bay, Osaka, 5 Mar. 1976, coll. Y. Hayashi (TOYA-Cr 23242); 1 non-ovig. female (32.0 mm), on pectoral fin of *M. cephalus*, Shimo-kamagari Island, Hiroshima, 28 Dec. 2005, coll. T. Umino (TOYA-Cr 23243); 2 females (not measured), on pectoral fin of *Acanthopagrus latus* (Houttuyn), Hiroshima Bay, Hiroshima, 25 May 2007, coll. T. Umino (TOYA-Cr 23244, 23245); 1 non-ovig. female (23.0 mm), on pectoral fin of *A. s. schlegelii*, Ôkurokami Island, Hiroshima, 13 Jun. 2006, coll. K. Nagasawa (TOYA-Cr 23246); 1 non-ovig. female (24.0 mm), on the caudal surface of pectoral fin of *A. s. schlegelii*, Shimo-kamagari Island, Hiroshima, 28 Dec. 2005, coll. T. Umino (TOYA-Cr 23247); 1 ovig. female (33.0 mm), 1 non-ovig. female (20.5 mm), on caudal fin of *A. s. schlegelii*, Shimo-kamagari Island, Hiroshima, 28 Dec. 2005, coll. T. Umino (TOYA-Cr 23248, 23249); 1 ovig. female (27.0 mm), ex. *A. s. schlegelii* (29.0 cm TL), Tamano, Okayama, 21 Jun. 2007, coll. A. Nishimura (TOYA-Cr 23250); 1 non-ovig. female (24.0 mm), on body surface of *A. s. schlegelii*, off Sakai, Osaka, 31 May 1999, coll. H. Ariyama (OMNH Ar6166); 1 female (not measured), on caudal fin of *Ditrema viride* Oshima, Aboshi, Himeji, Hyogo, 8 Jan. 2003, coll. T. Miki (the specimen is no longer extant); 1 ovig. female (25.0 mm), 5 males (15.0, 16.5, 17.5, 18.0, 20.5 mm), on caudal fin of *Lateolabrax japonicus* and *D. viride*, Aboshi, Himeji, Hyogo, 18 May 2004, coll. T. Miki (HCA-H No.17); 1 ovig. female (24.0 mm), at pectoral fin base of *Chaenogobius gulosus* (Sauvage), Onomichi Fish Market, Hiroshima, 12 Jul. 1960, coll. Y. Shibata (OMNH); 1 ovig. female (21.0 mm), on pectoral fin of *Acanthogobius flavimanus* (Temminck & Schlegel) (20.0 cm TL), Misaki, Osaka, 7. Sep. 2005, coll. A. Aimoto

(TOYA-Cr 23251); 1 ovig. female (19.0 mm), 1 aegathoid (10.5 mm), on pectoral fin of *A. flavimanus* (23.5 cm TL), Kawajiri, Hiroshima, 1 Jan. 2004, coll. T. Morihisa (TOYA-Cr 23252, 23253); 1 non-ovig. female (23.0 mm), host unknown, Hiroshima Bay, Hiroshima, Nov. 2007, Coll. K. Nagasawa (TOYA-Cr 23254); 5 non-ovig. female (9.0, 10.0, 16.0, 18.0, 20.0 mm), 1 male (15.0 mm), on pectoral fin of *Chelon haematocheilus* (Temminck & Schlegel), Kanda Port, Fukuoka, 21 Dec. 1976, coll. K. Izawa (TOYA-Cr 23255–23260); [**Ariake Sea**] 1 non-ovig. female (27.0 mm), on pectoral fin of *Lateolabrax japonicus* (50.4 cm TL, age 4, FAKU129257), unknown locality, Dec. 2000, coll. N. Nakadachi (TOYA-Cr 23261); 1 non-ovig. female (16.0 mm), Mar. 2006, on caudal fin of *L. japonicus*, Yatsushiro, Kumamoto, coll. H. Yoshigou (TOYA-Cr 23262); 1 ovig. female (34.0 mm), on caudal fin of *L. latus* Katayama (70.0 cm TL), Tomioka, Kumamoto, 3 Apr. 2004, coll. S. Arakaki (TOYA-Cr 23263); 1 non-ovig. female (18.0 mm), on pectoral fin of *L. latus* (62.0 cm TL), Tomioka, Kumamoto, 19 Jan. 2004, coll. S. Arakaki (TOYA-Cr 23264); 1 non-ovig. female (18.0 mm), on anal fin of *L. latus* (60.0 cm TL), Tomioka, Kumamoto, 11 Mar. 2004, coll. S. Arakaki (TOYA-Cr 23265); 1 female (19.0 mm), on caudal fin of *Liza affinis* (Günther) (22.5 cm TL), 11 Mar. 2008, mouth of Saza River, Saza, Nagasaki, coll. H. Yoshigou (TOYA-Cr 23266); [**North Pacific Ocean**] 1 ovig. female (16.0 mm), on body surface of *Acanthogobius flavimanus*, 10 Oct. 1992, mouth of Hatauchi River, Shimizu, Shizuoka, coll. T. Kato (KMNH IvR 500,538); 1 ovig. female (41.0 mm), on pectoral fin of *Lateolabrax japonicus* (73.0 cm TL), Mongawa Bay, Miyazaki, at depth of 8 m, 24 Apr. 2007, coll. M. Wada (the specimen is no longer extant); 1 non-ovig. female (34.0 mm), on caudal fin of *L. latus* (31.5 cm TL), Mongawa Bay, Miyazaki, at depth of 8 m, 8 Jun. 2007, coll. M. Wada (TOYA-Cr 23267); 1 ovig. female (32.0 mm), on pectoral fin of *Acanthopagrus s. schlegelii* (30–35 cm TL), Mongawa Bay, Miyazaki, at depth of 6 m, 21 May 2007, coll. M. Wada (TOYA-Cr 23268); [**East China Sea**] 1 non-ovig. female (20.0 mm), 8 Aug. 2005, on pectoral fin of *Rhyncopelates oxyrhynchus* (Temminck & Schlegel), off Kataura, Kasasa, Kagoshima, at depth of 27 m, 8 Aug. 2005, coll. M. Ito (TOYA-Cr 23269); 1 ovig. female (23.0 mm), on pectoral fin of *Aluterus monoceros* (Linnaeus), off Kataura, Kasasa,

Kagoshima, at depth of 27 m, 23 Sep. 2005, coll. M. Ito (TOYA-Cr 23270).

Material used in previous identifications: [**Sea of Japan**] 1 ovig. female (21.5 mm), Ao, Himi, Toyama, 18 Sep. 1979, coll. Toyama Prefectural Fisheries Experiment Station (TOYA Z80-189, recorded as *Nerocila acuminata* in Nunomura, 1985); 1 ovig. female (26.5 mm), host unknown, Kokufu, Himi, Toyama, 9 Jun. 1974, coll. S. Tanaka (TOYA Z82-76, recorded as *N. acuminata* in Nunomura, 1985).

Redescription (Figs. 1–7)

Holotype (non-ovigerous female)

Body *c.*1.75 times as long as maximum width, bilaterally symmetrical (Fig. 1A); pereon dorsum vaulted (Fig. 1C). Cephalon anterior margin evenly rounded (Fig. 1D), without indistinct medial point; eye obscured. Pereonites 1–4 with posterolateral angles produced; pereonites 5–7 with posterolateral angles strongly produced, acute (Fig. 1C). Coxae of pereonites (Fig. 1B,C) with posterior margins acute. Ventrolateral margins of pleonites 1 and 2 (Fig. 1B) posteriorly directed, extending to pleonite 5. Pleotelson (Fig. 1E) shield-shaped, with lateral margins converging to caudomedial point.

Antennule (Fig. 1D) with 8 articles. Antenna with 6 articles (apical articles absent) (Fig. 1D).

Pereopods 1–6 with robust dactyli (Fig. 1B). Pereopod 1 dactylus (Fig. 1B) *c.*1.6 times as long as propodus. Dactyli of pereopods 4 and 5 with weak swelling (Fig. 1B). Pereopods 6 and 7 with weakly developed carina on bases (Fig. 1B); pereopod 7 with robust setae on posterior margin of ischium, merus, carpus and propodal palm (Fig. 1B).

Uropod exopod curving medially (Fig. 1E), *c.*1.3 times as long as endopod; endopod straight, with distal margin smoothly tapered.

Ovigerous female

Body *c.*2.0 times as long as maximum width, bilaterally symmetrical (Fig. 2A,C); pereon dorsum vaulted (Fig. 3A–B). Cephalon anterior margin rounded, with or without indistinct medial point (Fig. 4A); eye obscured. Pereonites 1–4 with posterolateral angles produced or not; pereonites 5–7 with posterolateral angles produced, acute (Figs. 2A,C, 3A,B). Coxae of pereonites 2–4 with posterior margins rounded or acute; coxae of pereonites 5–7 with posterior margins

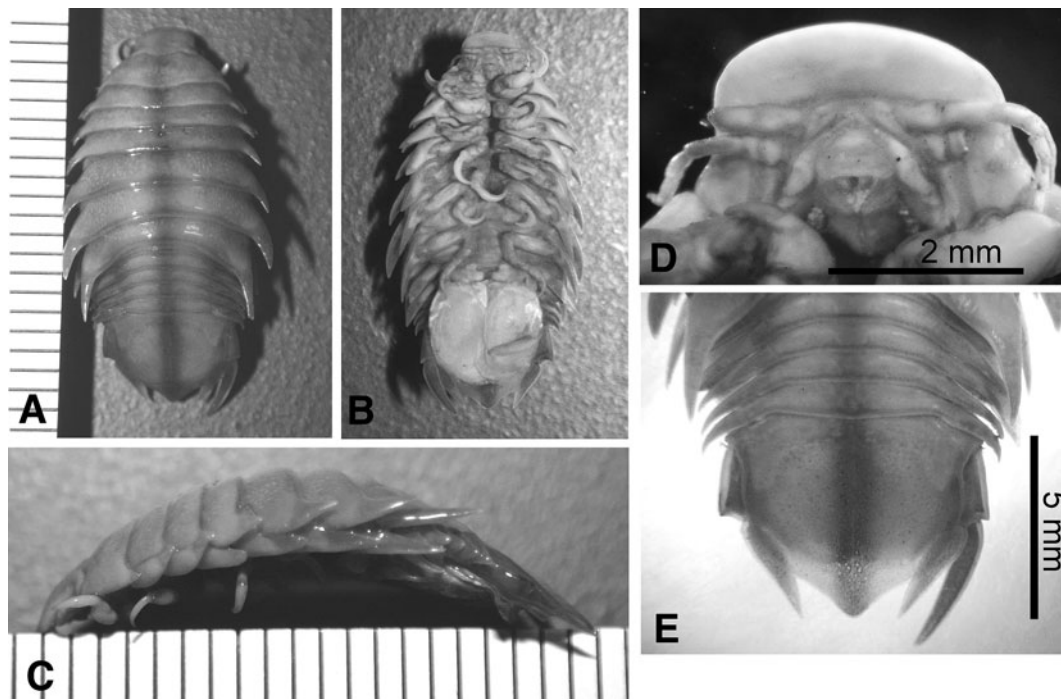


Fig. 1 Holotype of *Nerocila japonica*, non-ovigerous female (19.5 mm; SMNH Type-8206). A, habitus, dorsal; B, habitus, ventral; C, habitus, lateral; D, frons, ventral; E, pleon and pleotelson, dorsal. Scales: in mm

acute. Ventrolateral margins of pleonites 1 and 2 posteriorly directed, extending to or beyond pleonite 5 (Figs. 2A,C, 3A,B). Pleotelson (Fig. 2A,C) shield-shaped, with lateral margins converging to caudomedial point.

Antennule with 8 articles; article 1 and 2 partly fused (Fig. 4C). Antenna with 9 articles (Fig. 4D). Mandibular palp of article 3 with 8 setae on distolateral margin (Fig. 4E). Maxillule with 4 spines (Fig. 4F). Maxilla with 2 spines, each on medial and lateral lobes (Fig. 4G). Maxilliped article 3 with 6 spines (Fig. 4H).

Pereopods 1–6 with robust dactyli (Fig. 5A,B). Dactylus of pereopod 1 (Fig. 5A) $c.1.7$ times as long as propodus. Dactyli of pereopods 1, 2, 4 and 5 with or without weak swelling (Fig. 5A). Pereopods 6 and 7 with weakly developed carina on bases (Fig. 5B,C); pereopod 7 with 1–2 robust setae on posterior margin of ischium, 3 robust setae on posterior margin of merus, 3–8 robust setae on posterior margin of carpus and 7–11 robust setae on propodal palm (Fig. 5C).

Appendix masculina of pleopod 2 (Fig. 5D) $c.0.6$ length of endopod; pleopod 5 endopod with 2 large folds (Fig. 5E). Uropod exopod curves medially

(Fig. 5F), $c.1.3$ times as long as endopod; endopod straight, with distal margin smoothly tapered.

Male

Body $c.2.4$ times as long as wide (Fig. 2D) and $c.3.6$ times in aegathoids (Fig. 2E). Eyes large and distinct in small individuals, but facets indistinct in large individuals. In males and aegathoids, coxae and posterolateral margins of pereonites not as produced as in females. Uropod morphology similar to that of females in large males, but uropod endopod with convex median margin in small males and aegathoids.

Coloration. Dark blue, with 2 faint submedian pale longitudinal bands visible in life and in alcohol.

Size. 15.0–20.5 (mean 17.3) mm in males ($n = 11$) and 9.0–41.0 (22.9) mm in females ($n = 40$).

Variation. Bruce (1987) stated that in *N. orbigny* (Guerin-Maneville, 1832) there is considerable variation in the degree of prolongation of the posterolateral angles of the pereonites, in coxal shape and in pleonite morphology. This character cannot be considered as of specific significance. The ventrolateral processes of pleonites 1 and 2 may project away from

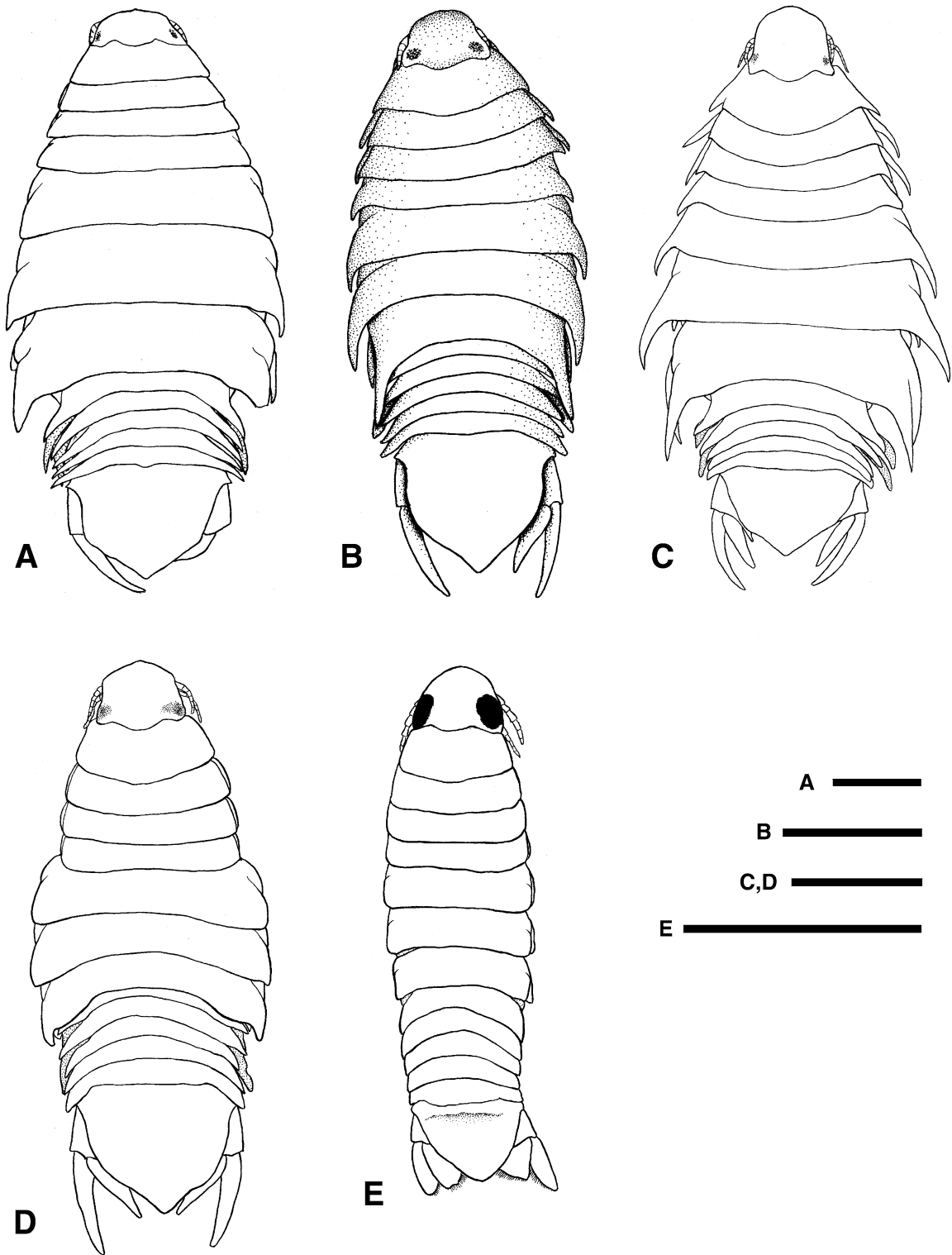


Fig. 2 *Nerocila japonica*, habitus, dorsal. A, 'acuminata form', ovigerous female (32.0 mm; TOYA-Cr 23268); B, 'acuminata-aster intermediate form', non-ovigerous female (19.0 mm; TOYA-Cr 23236); C, 'aster form', ovigerous female (18.5 mm; TOYA-Cr 23234); D, male (19.5 mm; TOYA-Cr 23232); E, aegathoid (10.5 mm; TOYA-Cr 23253). Scale-bars: 5 mm

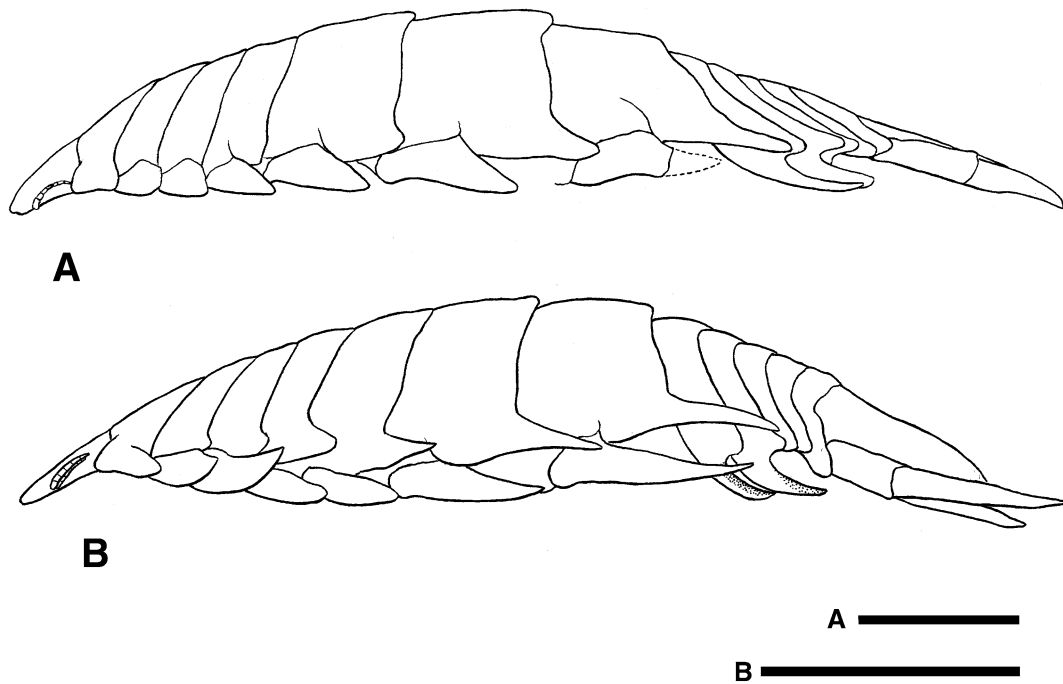


Fig. 3 *Nerocila japonica*, ovigerous female, habitus, lateral. A, 'acuminata form' (32.0 mm; TOYA-Cr 23268); B, 'aster form' (18.5 mm; TOYA-Cr 23234). Scale-bars: 5 mm

the pleon, and extend posteriorly to pleonite 4 or beyond pleonite 5. The posterior coxae may have concave, convex or straight posterior margins.

There are two distinct morphological forms in *N. japonica*: the 'acuminata form' (Figs. 2A, 3A) and the 'aster form' (Figs. 2C, 3B), as occurs in *N. acuminata* (see Brusca 1981). In addition, intermediates (Fig. 2B) between the two forms were found. Hence, significant variation is found in the posterolateral margins of pereonites 1–5 and the coxae of these pereonites.

Remarks

The general characteristics of the newly collected ovigerous females correspond with the morphology of the holotype of *Nerocila japonica*.

Nerocila acuminata and *N. orbignyi*, members of the '*Nerocila orbignyi* group', have the uropod endopod with a distomedial point (Bruce, 1987). We confirmed that *N. japonica* is distinguishable from other species in the '*N. orbignyi* group' by having a uropod endopod with straight margins which converge to an acute apex, as indicated by Bruce (1987). Although the acute lateral margins on pleonites 3–5,

the acute posterolateral margins of pereonites 1–4 and the acute coxae of pereonites 2–4 have been reported as diagnostic characters (Bruce, 1987, p. 383, figs. 34G–J), they have proved to be unreliable for separating *N. japonica* from the other species due to the above-mentioned intraspecific variation.

Sato (2001) showed colour photographs of an unidentified isopod attached on the pelvic fin of *Lates japonicus* Katayama & Taki collected from Tokushima Prefecture, Shikoku, Japan. There is little doubt that the isopod represents *N. japonica* based on the shape of its uropod endopod.

Bruce (1987, p. 400) suspected that *N. acuminata* reported from Japan (Nunomura, 1981) might actually represent *N. japonica*. Based on the previous records of *N. acuminata* in Japan, we discuss their synonymy with *N. japonica* in detail below.

Distribution

Nerocila japonica has been recorded from off Japan (Schioedte & Meinert, 1881; Hashimoto, 2007; Present study), China (Yu & Li, 2003) and Penang, Malaysia (Nierstrasz, 1918). In Japanese waters, *N. japonica* was collected from the coast of the Sea of Japan off Honshu (Toyama Bay and Lake

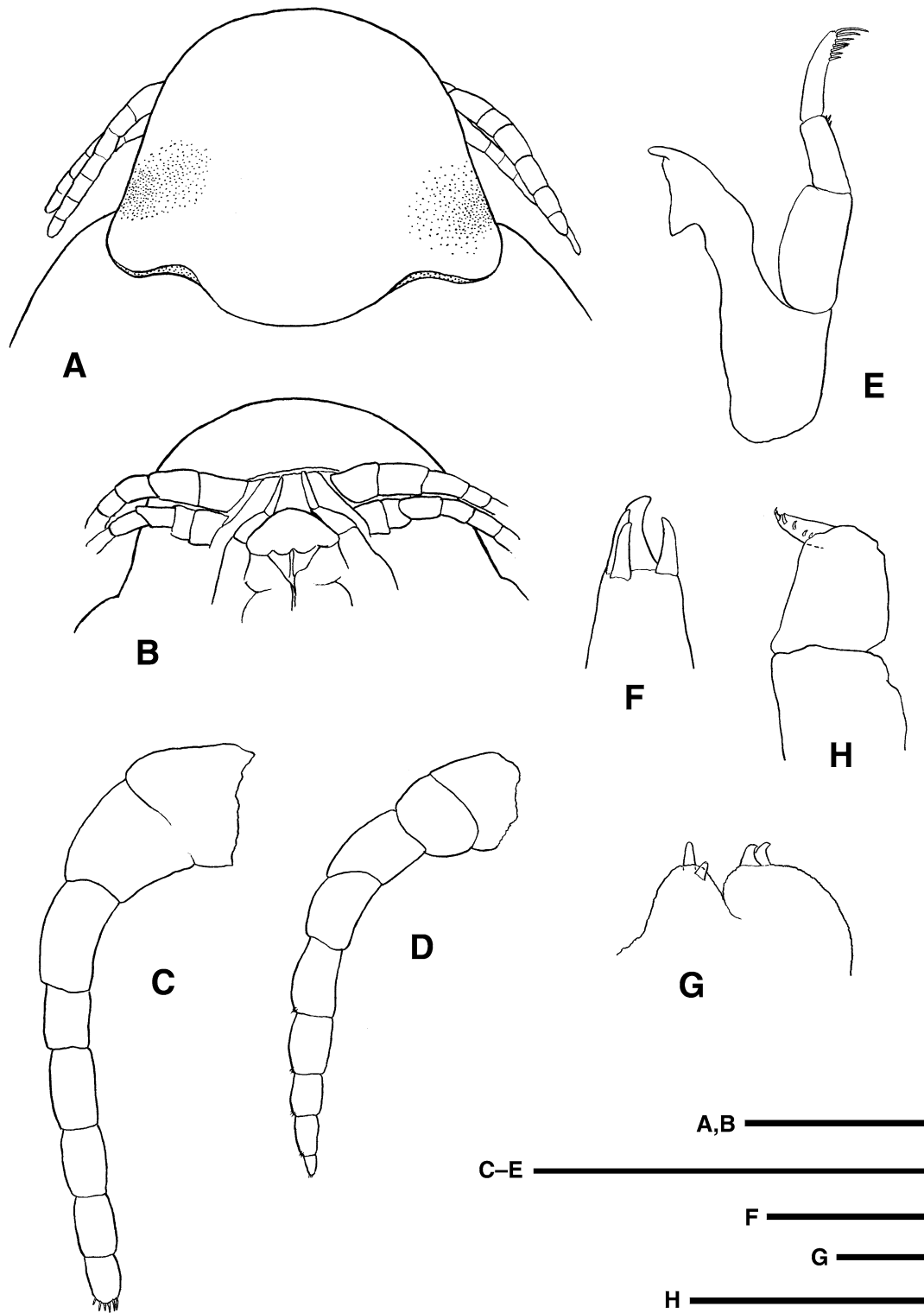


Fig. 4 *Nerocila japonica*, ovigerous female (24.0 mm; OMNH Ar6166). A, head, dorsal; B, frons, ventral; C, left antennule, dorsal; D, left antenna, dorsal; E, left mandible, ventral; F, left maxillule, ventral; G, left maxilla, ventral; H, left maxilliped, ventral. Scale-bars: A–D, 2 mm; E, H, 1 mm; F, G, 0.1 mm

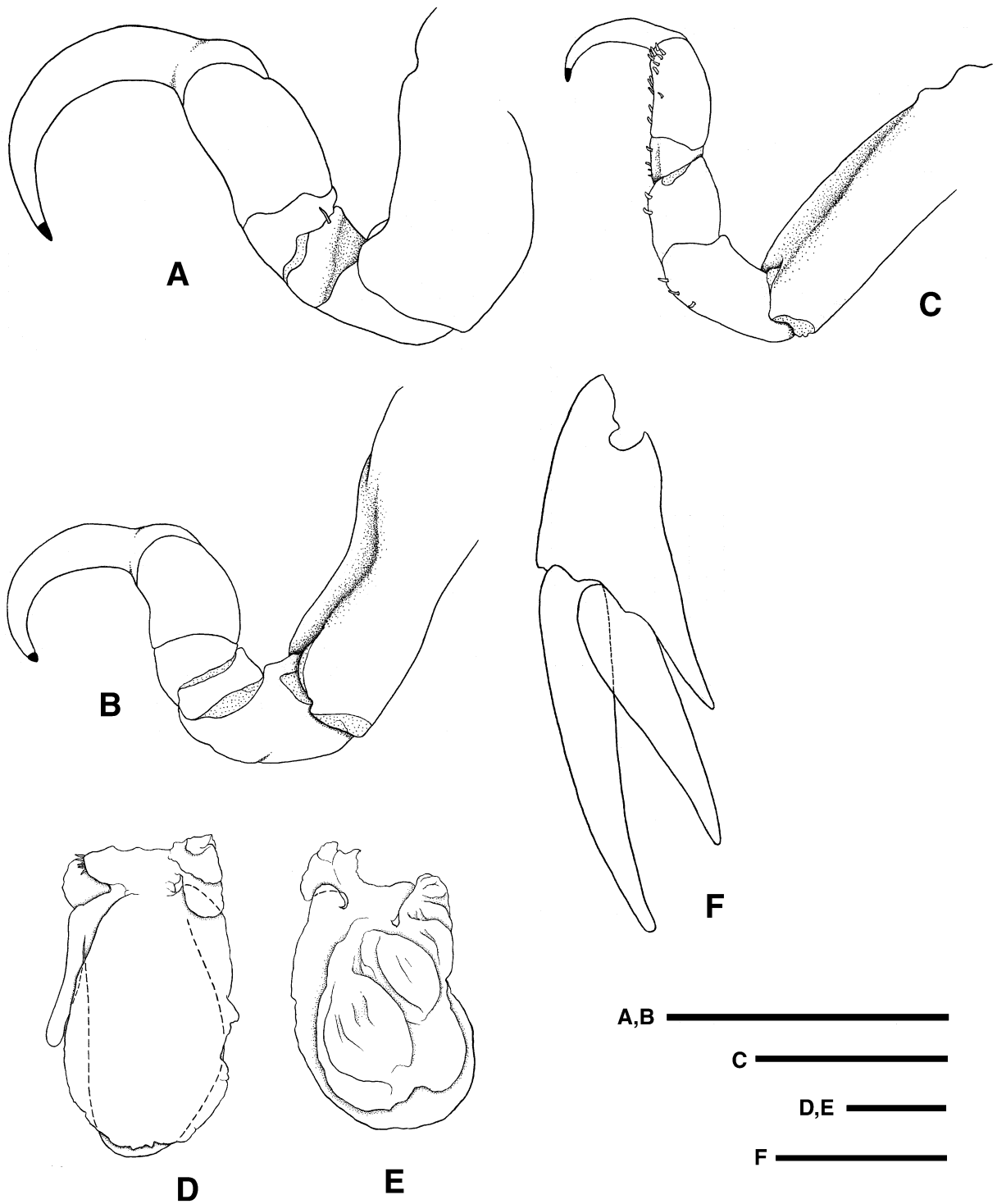


Fig. 5 *Nerocila japonica*, ovigerous female (24.0 mm; OMNH Ar6166). A, left pereopod 1, medial; B, left pereopod 6, medial; C, left pereopod 7, medial; D, pleopod 2, ventral; E, pleopod 5, medial; F, left uropod, dorsal. Scale-bars: 2 mm

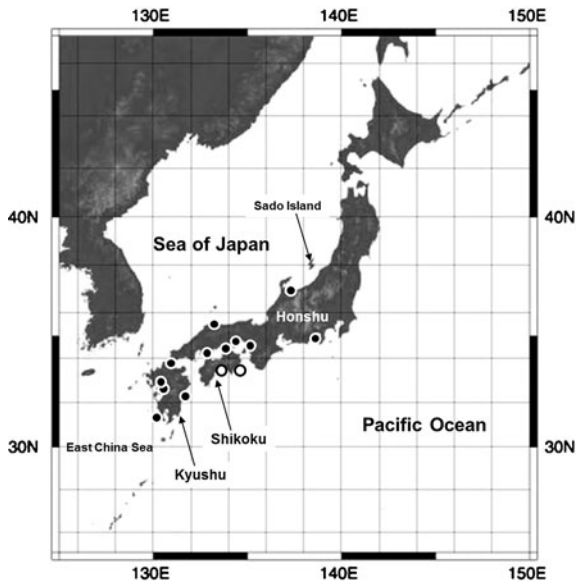


Fig. 6 Distributional records of *Nerocila japonica* in Japan. Closed and open circles represent localities reported in this paper and by previous authors (Sato, 2001; Hashimoto, 2007), respectively

Nakaumi), the Pacific coast from Suruga Bay to Kyushu, the Seto Inland Sea and the East China Sea coast off Kyushu (Fig. 6). Specimens of this species were found on the fish taken at the depths of 6–27 m.

Hosts

Nerocila japonica is known to infect *Lates japonicus* (Latidae) (Hashimoto, 2007). In the present study, the following species are newly recorded as hosts: the big-scaled redbfin *Tribolodon hakonensis* (Cyprinidae), the flathead mullet *Mugil cephalus* (Mugilidae), the eastern keelback mullet *Liza affinis* (Mugilidae), the so-iny mullet *Chelon haematocheilus* (Mugilidae), the Japanese seaperch *Lateolabrax japonicus* (Lateolabracidae), the blackfin seabass *L. latus* (Lateolabracidae), the yellowfin seabream *Acanthopagrus latus* (Sparidae), the blackhead seabream *A. schlegelii schlegelii* (Sparidae), *Rhyncopelates oxyrhynchus* (Terapontidae), *Ditrema viride* (Embiotocidae), *D. temminckii temminckii* (Embiotocidae), *Chaenogobius gulosus* (Gobiidae), the yellowfin goby *Acanthogobius flavimanus* (Gobiidae), *Pseudolabrus* sp. (the red naped wrasse, either *P. eoethinus* or *P. sieboldi*) (Labridae) and the unicorn leatherjacket *Aluterus monoceros* (Monacanthidae). These host records indicate that *N. japonica* has a low

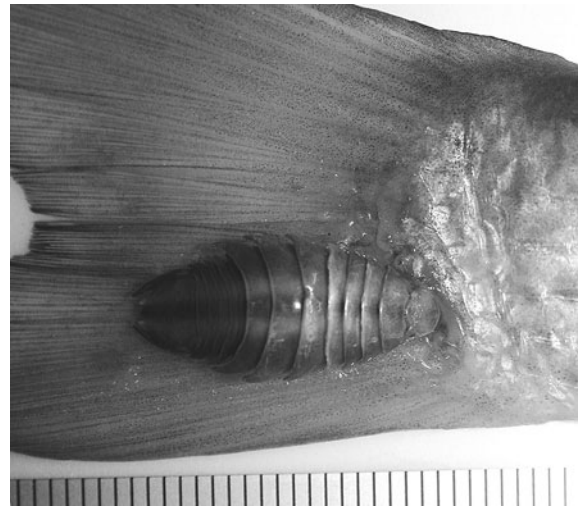


Fig. 7 Female of *Nerocila japonica* (19.0 mm; TOYA-Cr 23266) attached at the base of the caudal fin of *Liza affinis*. Scale: in mm

host-specificity. This species attaches at the base of a fin or to the fin proper along the fin rays of its fish host (Fig. 7).

Ecological notes

The collection of specimens of *N. japonica* from a brackish-water lake and the mouth of rivers suggests that this species can tolerate low salinity, as is the case with *N. orbignyi* and *N. acuminata* (see Brusca, 1981).

The coloration of the dorsal surface of *N. japonica* (dark blue with two faint pale submedian longitudinal bands) is almost the same as that of *N. orbignyi* and *N. acuminata* (see Brusca, 1981; Bruce, 1987). This species probably camouflages itself on the attachment sites of its host fish using its stable bilaterally symmetrical coloration. A similar suggestion has been made by Körner (1982) for *N. bivittata* (Risso, 1816).

An extensive skin erosion was often observed at the attachment site of *N. japonica*. Lesions observed in the present study resemble those caused by *N. acuminata* (Rand, 1986). *N. japonica* may cause anaemia and result in a secondary bacterial infection of the infected host. More study is needed on this species, because only limited information is available on its ecology and pathology.

A small bivalve (not identified) was found attached to the left coxa of pereonite 6 of a male *N. japonica*

(19.0 mm) collected from *Tribolodon hakonensis* in the brackish Lake Nakaumi.

Comments on previous records of *Nerocila acuminata* in Japanese waters

Nerocila acuminata is known as an East Pacific and Caribbean species and was recorded from about 40 host fish species in the eastern Pacific (Brusca, 1981). On the other hand, this species has also been recorded from off Japan (Iwasa, 1947; Shiino, 1965; Honma et al., 1974; Nunomura, 1981, 1985). Saito et al. (2000) cited these records of *N. acuminata* in their checklist of isopods of Japan.

Iwasa (1947) recorded *N. acuminata* from Japanese waters in an encyclopaedia of the fauna of Japan. His description is brief, but it includes a diagnostic feature, i.e. the uropod endopod with a serrate medial margin and a truncate distal margin. This feature strongly suggests that he actually found an unrecorded *Nerocila* species close to *N. serra* Schioedte & Meinert, 1881, although it is impossible to determine which species without a re-examination of Iwasa's material. Shiino (1965) also recorded Iwasa's (1947) species as *N. acuminata* from Japan.

Honma et al. (1974) recorded *N. acuminata* in a faunal list of a brackish-water lake (Kamo-ko) on Sado Island located in the Sea of Japan, but gave no diagnostic information. Nunomura (1981) also recorded *N. acuminata* from Sado Island (two specimens on the body surface of *Tribolodon hakonensis* (as *Leuciscus (Tribolodon) hakonensis*) and two specimens without host data), but he did not give any diagnostic information. In his annotated list of the species in *Nerocila*, Bruce (1987, p. 400) suspected that *N. acuminata* reported by Nunomura (1981) might actually represent *N. japonica*. The specimens recorded by Nunomura (1981) were deposited at the Sado Marine Biological Station (SMBS), Niigata University (N. Nunomura, pers. comm.). At our request Mr T. Shimotani of the SMBS tried to find these specimens, and one of us (KN) also examined invertebrate specimens preserved at the SMBS, but no cymothoid material could be found. The specimens recorded by Honma et al. (1974) and Nunomura (1981) are presumed not to be extant; therefore, the identity of those specimens is uncertain. Based on current information on the geographical ranges of the

two *Nerocila* species, it is likely that both Honma et al. (1974) and Nunomura (1981) actually misidentified specimens of *N. japonica* as *N. acuminata*.

Nunomura (1985) recorded two females of *N. acuminata* from Toyama Bay (the Sea of Japan). We re-examined these specimens deposited in the TOYA and concluded that these are *N. japonica* (see above under *Material used in previous identifications*).

There has so far been no reliable record of *N. acuminata* from Japanese waters. Therefore, records of *N. acuminata* from Japan should not be regarded as being *N. acuminata*. In addition, Iwasa's (1965) record of *N. acuminata* from off Taiwan is questionable in view of current information on the geographical range of this species.

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