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Note

Supplementary information on the taxonomy and distribution of six species of *Anisomysis* (Crustacea: Mysidacea: Mysidae)

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The genus *Anisomysis* Hansen, 1910, is widely and abundantly distributed in the Indo-West Pacific region and includes 40 species and two subspecies. They may have an important role in coastal marine ecosystems owing to their abundance. This paper provides supplementary information on the taxonomy and distribution of six of the lesser known species of *Anisomysis*.

Body length was measured from the tip of the rostrum to the distal end of the telson excluding spines. Data on the specimens collected from the Ogasawara Islands is summarized in Table 1.

Anisomysis akajimaensis Murano, 1990

Anisomysis akajimaensis Murano, 1990, p. 207–209, Fig. 15.—Müller, 1993, p. 201 (list).

Materials

Ogasawara Islands, southern Japan. Abundant males (adult: 4.1–4.4 mm) and females (adult: 4.0–4.3 mm), Nagasaki. 1 male (4.0 mm) and 1 female (4.5 mm), Takinoura.

Geographical distribution

Anisomysis akajimaensis was originally described from Aka-jima Island, Okinawa (Murano 1990). The present occurrence from the Ogasawara Islands is the second record.

Anisomysis bifurcata Tattersall, 1912 (Fig. 1A–F)

Anisomysis bifurcata Tattersall, 1912, p. 126–127, pl. 7, Figs 1–6.—Gordan, 1957, p. 340 (list).—Mauchline & Murano, 1977, p. 47 (list).—Müller, 1993, p. 201 (list).—Fukuoka & Murano, in press.

Materials

1) Ogasawara Islands. 1 male (5.5 mm), Futami Harbor. 57 males (3.6–6.0 mm), 6 immature males (3.2–3.6 mm), 89 females (3.7–5.8 mm) and 11 immature females (3.2–4.0 mm), Stn OS1. 8 males (4.0–4.8 mm), 6 females (4.5–5.0 mm) and 3 immature females (4.0–4.2 mm), Stn OS2. 1 male (4.7 mm), Stn OS3. 2 males (5.4 and 5.9 mm) and 2 females (5.3 and 5.7 mm), Stn OS6. 1 male (5.8 mm) and 2 females (4.5 and 5.2 mm), Stn OS7. 38 males (4.3–5.0 mm) and 15 females (3.8–5.0 mm), Stn OS9. 6 males (4.0–5.0 mm) and 4 females (4.2–5.3 mm), Stn OS10. 7 males (3.7–5.8 mm), 7 females (4.0–4.4 mm) and 6 immature females (3.3–3.8 mm), Stn OS11. 1 male (4.5 mm) and 1 female (4.0 mm), Stn OS12. 6 males (3.8–5.6 mm), 7 immature males (1.8–2.6 mm), 4 females (3.7–4.0 mm), 4 immature females (3.4–3.7 mm) and 20 juveniles (1.8–2.9 mm), Stn L1. 3 males (3.8–5.0 mm), 1 female (5.6 mm) and 1 immature female (3.0 mm), Stn L2. 1 male (5.6 mm), Stn L8. 1 male (5.3 mm), 8 females (4.7–5.7 mm), 6 immature females (4.0–4.4 mm) and 8 juveniles (1.3–2.5 mm), Stn L10. 4 males (4.0–4.2 mm) and 2 females (4.6 and 5.8 mm), Stn L11. 7 males (3.7–5.4 mm) and 6 females (4.2–5.8 mm), Stn L12. 3 males (4.4–5.8 mm), Stn L13. 1 male (5.0 mm), Stn L14. 2 females (4.3 and 5.0 mm), Stn CH10. 45 males (4.7–6.5 mm) and 32 females (4.5–6.5 mm), 27°08′N 142°12′E.

2) Ishigaki Island, Ryukyu Islands, southwestern Japan. 1 immature female (3.0 mm), Urasoko Bay, hand net, 4 m, rock and coral, 10 June 1999, coll. K. Fukuoka.

3) Panay Island, Philippines. 1 female (5.4 mm) and 1 immature female (4.1 mm), 11°45′N 121°50′E, surface tow with plankton net, 26 Apr. 1979, provided by Southeast Asian Fisheries Development Center.

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Table 1. Collection data on the specimens from the Ogasawara Islands.

Locality or position	Date	Method	Depth
Miyanohama, Chichi-jima Is.	16 June 1995	Hand net during skin diving (coll. K. Fukuoka)	0.5–3 m
Futami Harbor, Chichi-jima Is.	16 June 1995	Towing net under a light at night (coll. K. Fukuoka)	Surface
Oki Harbor, Haha-jima Is.	17 June 1995	Towing net under a light at night (coll. K. Fukuoka)	Surface
Higashi Harbor, Haha-jima Is.	18 June 1995	Hand net during skin diving (coll. K. Fukuoka)	1–5 m
Kopepekaigan, Chichi-jima Is.	19 June 1995	Hand net during skin diving (coll. K. Fukuoka)	1–2 m
Ougiura, Chichi-jima Is.	20 June 1995	Hand net during skin diving (coll. K. Fukuoka)	1–5 m
Takinoura, Ani-jima Is.	20 June 1995	Hand net during SCUBA diving (coll. T. Ishimaru)	15 m
Nagasaki, Chichi-jima Is.	20 June 1995	Hand net during SCUBA diving (coll. T. Ishimaru)	15–20 m
Kita Harbor, Haha-jima Is.	19 Oct. 1998	Hand net during skin diving (coll. K. Fukuoka)	0.5–1 m
Stn OS1 (26°41.24′N 142°09.47′E)	18 June 1995	Bottom net (TR/V Seiyo-Maru)	55–60 m
Stn OS2 (26°42.02′N 142°10.95′E)	18 June 1995	Bottom net (TR/V Seiyo-Maru)	162 m
Stn OS3 (26°43.68′N 142°12.05′E)	18 June 1995	Bottom net (TR/V Seiyo-Maru)	192–200 m
Stn OS6 (26°52.75′N 142°18.60′E)	18 June 1995	Bottom net (TR/V Seiyo-Maru)	1040–1124 m
Stn OS7 (26°56.01′N 142°17.36′E)	19 June 1995	Bottom net (TR/V Seiyo-Maru)	1192–1327 m
Stn OS9 (27°00.22′N 142°14.10′E)	19 June 1995	Bottom net (TR/V Seiyo-Maru)	171–203 m
Stn OS10 (27°01.17′N 142°13.05′E)	19 June 1995	Bottom net (TR/V Seiyo-Maru)	139–124 m
Stn OS11 (27°01.74′N 142°12.48′E)	19 June 1995	Bottom net (TR/V Seiyo-Maru)	95–99 m
Stn OS12 (27°01.80′N 142°12.22′E)	19 June 1995	Bottom net (TR/V Seiyo-Maru)	51–68 m
Stn L1 (Higashi Harbor, Haha-jima Is.)	18 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L2 (26°41.51′N 142°10.08′E)	18 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L8 (26°52.86′N 142°17.83′E)	19 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L10 (27°00.12′N 142°14.36′E)	19 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L11 (27°01.10′N 142°13.39′E)	19 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L12 (27°01.46′N 142°12.12′E)	19 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L13 (27°01.73′N 142°12.20′E)	19 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn L14 (27°01.62′N 142°11.90′E)	19 June 1995	Larva net at night (TR/V Seiyo-Maru)	Surface
Stn CH10 (27°00.28′N 142°10.40′E)	20 Oct. 1998	Bottom net (TR/V Shinyo-Maru)	123–125 m
27°08′N 142°12′E	14 June 1999	Towing net under a light at night (coll. K. Nishikiori)	Surface

4) Christmas Island, Western Australia. Abundant males and females (adult: 4.5–5 mm), WAM-23618 (Western Australian Museum), Flying Fish Cove, from the stomach of a whale shark (*Rhincodon typus* Smith, 1828), 12 Jan. 1996, coll. B. Norman.

Remarks

Anisomysis bifurcata Tattersall, 1912, was described based on specimens collected from the Chagos Islands and Farquhar Island, Indian Ocean. This species is closely allied to *Anisomysis spinata* Panampunnayil, 1993 described from near the Kalpeni Atoll, the Lakshadweep archipelago, India. Panampunnayil (1993) indicated differences between these two species in the rostrum, antennal scale, fourth pleopod of males, uropodal endopod, telson, and body length. The present observation on abundant specimens collected from the waters of the Ogasawara Islands and Christmas Island clarified that these characters are morphologically variable (Fig. 1A–F, Table 2) and were not necessarily specific differences except for the uropodal endopod. With respect to the uropodal endopod, Tattersall (1912) did not refer to the spine in the ventral statocyst region, whereas Panampunnayil (1993) described and illustrated a pointed spine with articulation at the base in the statocyst region. One of the authors (KF) had an opportunity to examine a male type specimen of *A. bifurcata* (5.5 mm, BM (NH) No. 1946.11.26.65) on loan from the Natural History Museum, London. In this specimen, the presence in the ventral statocyst region of the blunt process was confirmed but it was neither pointed at the apex nor articulated at the base. All the present specimens also carried a blunt process such as that of the type specimen of *A. bifurcata* (Fig. 1D). Thus, the present specimens are identified as *A. bifurcata*. As a result, *A. spinata* is distinguished from *A. bifurcata* by only a slight difference in the uropodal endopod. Reexamination of the validity of *A. spinata* may be needed.

Ecological note

Tattersall (1912) obtained this species from 274.5 m depth to the north of the Chagos Islands and from the surface near Farquhar Island. In a Seiyo-Maru cruise carried out in June 1995, this species was collected mostly from the offshore area between Chichi-jima and Haha-jima Islands by larva net tows at the surface and by bottom net tows at various depths at night. In the latter samplings, the actual depth at which *A. bifurcata* specimens were collected is not known because the bottom net did not carry any opening-closing device. *Anisomysis bifurcata* seems to be distributed in the surface layer from the result of larva net tows.

In coastal areas around Chichi-jima Island, *A. bifurcata* was only collected in low numbers under electric light conditions at

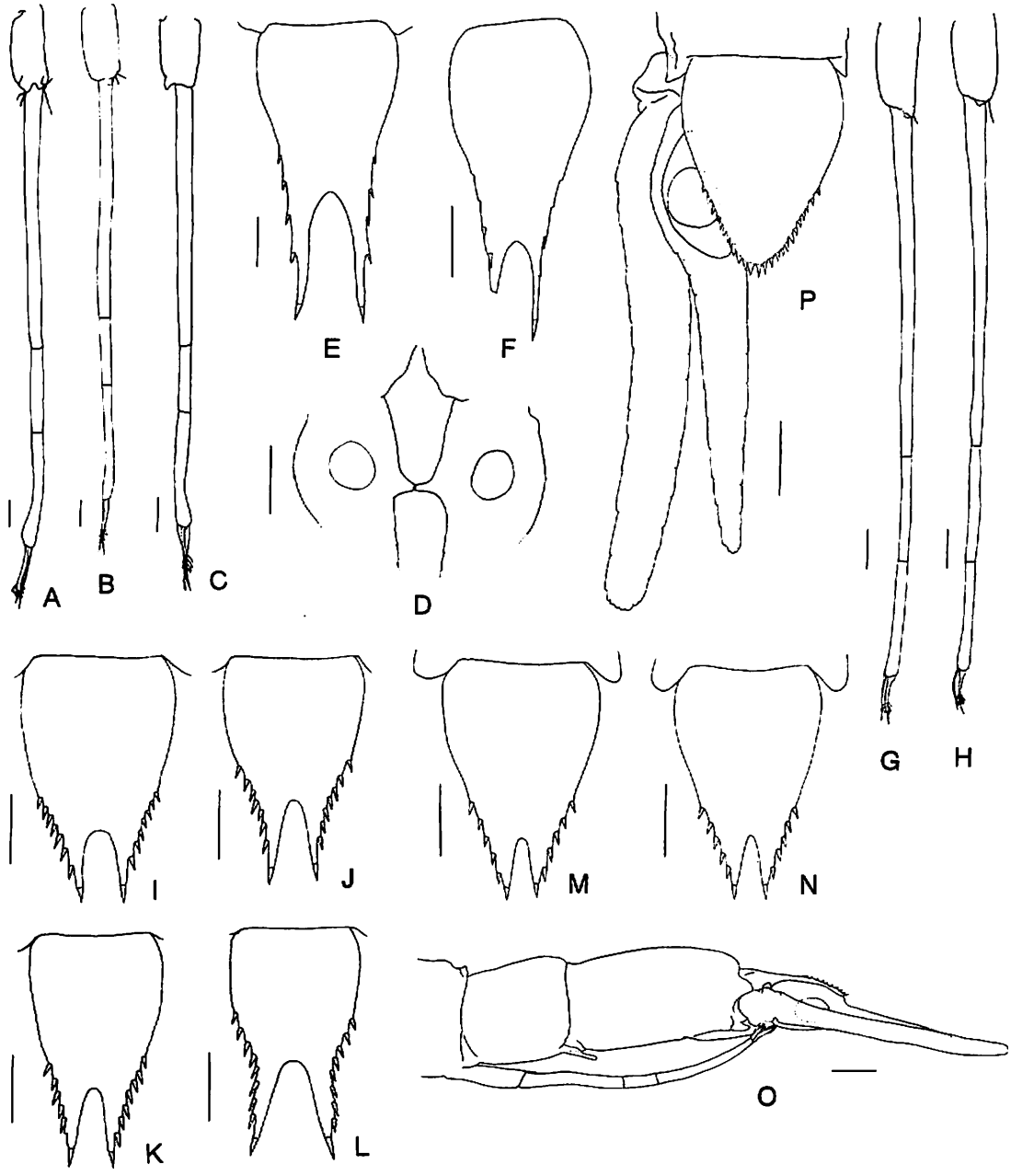

Fig. 1. A–F, *Anisomysis bifurcata* Tattersall, 1912. G, H, *Anisomysis enewetakensis* Murano, 1983. I–N, *Anisomysis pelewensis* Ii, 1964. O, P, *Anisomysis thurneysseni* Nouvel, 1973. A–C, G, H. Fourth pleopod of male. D. Endopod of uropod, ventral view. E, F, I–N. Telson. O. Distal half of abdomen, lateral view. P. Telson and uropod. A, D, E. Male (6.0 mm) from Stn OS1. B. Male (5.3 mm) from Stn OS1. C, F. Male (damaged) from Christmas Island. G. Male (5.2 mm) from Kopepekaigan. H. Male (4.0 mm) from Kopepekaigan. I. Male (3.5 mm) from Oki Harbor. J. Female (3.4 mm) from Oki Harbor. K. Male (3.1 mm) from Aka-jima Island. L. Female (3.3 mm) from Aka-jima Island. M. Male (3.1 mm) from Ishigaki Island. N. Female (2.9 mm) from Ishigaki Island. O, P. Male (3.1 mm) from Bali Island. Scale=0.1 mm.

night, and swarms were never observed; a large number of swarms of *A. akajimaensis*, *A. enewetakensis* and *A. pelewensis* were observed in layers of 15–20 m, 0.5–5 m, and 0.5–20 m depth, respectively. Thus, *A. bifurcata* is suggested to be an offshore species, unlike the three other species that exhibit swarming behavior.

A large number of *A. bifurcata* specimens were obtained from the stomach of a whale shark caught off Christmas Island, Western Australia. The second author (YH) also found a further specimen in the fecal material of the whale shark. In addition, Nishikiori (pers. comm.) observed swarming *A. bifurcata* being preyed upon by the manta ray, *Manta birostris* (Donndorff, 1798), at night. These facts indicate that *A. bifurcata* is exploited by some planktonivorous fishes.

Table 2. Comparison of characters between the original descriptions of *A. bifurcata* and *A. spinata*, and the specimens from the Ogasawara Islands and Christmas Island.

	Rostrum	Antennal scale	Exopod of male fourth pleopod	Endopod of uropod	Number of lateral spines of telson	Body length
A. bifurcata Tattersall, 1912 (Chagos Islands and Farquhar Island, Indian Ocean)	Narrow; reahes 1/2 of 1st segment of antennular peduncle; covers only narrow basal part of eye	5 times as long as broad	Extends to proximal 2/5 of telson; 1st segment 4.6 times as long as 2nd; 3rd segment twice as long as 2nd. (In reexamination. 1st segment 4.1 times as long as 2nd; 3rd segment 1.6 times as long as 2nd)	Blunt process not articulated at base present	5	Male: 5.5 mm
A. spinata Panampunnayil, 1993 (Kalpeni atoll, Lakshadweep archipelago, India)	Broad; reaches distal 1/4 of 1st segment of antennular peduncle; covers proximal 1/2 of eye	6 times as long as broad	Extends to distal end of telson; 1st segment 2.6 times as long as 2nd; 3rd segment shorter than 2nd	Pointed spine articulated at base present	6	Male: 3.4 mm, Female: 3.4 mm
Ogasawara specimens	Narrow to broad; reaches proximal 1/4 to distal end of 1st segment of antennular peduncle; covers narrow basal part to proximal 1/2 of eye	6–7 times as long as broad	Extends to proximal 2/5 to distal 1/4 of telson; 1st segment 2.9–4.5 times as long as 2nd; 3rd segment 1–1.6 times as long as 2nd	Blunt process not articulated at base present	3 or 4	Male: 3.6–6.5 mm, Female: 3.7–6.5 mm
Christmas specimens	Broad; reaches distal 1/3 of 1st segment of antennular peduncle; covers only narrow basal part of eye	Unexamined	Extends to distal 1/3 to end of telson; 1st segment 3.8 times as long as 2nd; 3rd segment 1.8 times as long as 2nd	Blunt process not articulated at base present	5	Male and Female: 4.5–5 mm

Geographical distribution

This species has been recorded from north of the Chagos Islands and Farquhar Island, Indian Ocean (Tattersall 1912), the Great Barrier Reef (Carleton & Hamner 1989), and Phuket Island, Thailand (Fukuoka & Murano in press). Thus, the present records from the Ogasawara Islands (southern Japan), Ishigaki Island (southwestern Japan), Panay Island (Philippines) and Christmas Island (Western Australia) provide a significant extension of the geographical range into the North Pacific. As a result, this species is widely distributed in the subtropical and tropical regions of the Indian and western Pacific Oceans.

Anisomysis enewetakensis Murano, 1983 (Fig. 1G, H)

Anisomysis enewetakensis Murano, 1983, p. 85–87, Fig. 3.—Müller, 1993, p. 202 (list).

Materials

Ogasawara Islands. Abundant males (adult: 4.0–4.8 mm) and females (adult: 4.0–5.3 mm), Miyanohama. Abundant males (adult: 4.1–4.8 mm) and females (adult: 4.2–5.0 mm), Oki Harbor. Abundant males (adult: 4.0–4.7 mm) and females (adult: 3.9–5.1 mm), Higashi Harbor. Abundant males (adult: 4.2–5.2 mm) and females (adult: 3.7–5.2 mm), Kopepekaigan. Abundant males (adult: 4.5–5.5 mm) and females (adult: 4.0–5.1 mm), Ougiura. Abundant males (adult: 3.9–4.5 mm) and females (adult: 3.7–4.2 mm), Kita Harbor.

Remarks

A variation in the exopod of the male fourth pleopod was observed; the third segment is shorter than the second segment in some individuals (Fig. 1H), as in the type specimens (Murano 1983), whereas it is slightly longer than the second in others (Fig. 1G).

Geographical distribution

To date this species has only been recorded from Enewetak Lagoon, Marshall Islands (Murano 1983). Thus, the occurrence in the Ogasawara Islands is the first record not only from Japanese waters but also from outside the type locality.

Anisomysis pelewensis Ii, 1964 (Fig. 1I–N)

Anisomysis pelewensis Ii, 1964, p. 565–567, Fig. 150.—Mauchline & Murano, 1977, p. 47 (list).—Valbonesi & Murano, 1980, p. 224–225, Fig. 8.—Murano, 1990, p. 197–199.—Müller, 1993, p. 206 (list).

Materials

Ogasawara Islands. 1 male (2.3 mm), Miyanohana. Abundant males (adult: 2.9–3.3 mm) and females (adult: 2.9–3.4 mm), Oki Harbor. 13 males (2.3–2.5 mm), 2 immature males (1.7–1.9 mm), 22 females (2.2–2.8 mm) and 13 immature females (1.8–2.2 mm), Kopepekaigan. 8 males (2.5–2.9 mm) and 60 females (2.5–2.9 mm), Nagasaki. Abundant males (adult: 2.2–2.9 mm) and females (adult: 2.2–2.8 mm), Takinoura.

Ryukyu Islands. 2 males (3.1 and 3.2 mm) and 2 females (3.0 and 3.3 mm), Agono-hama, Aka-jima Island, hand net, 15 m, 17 Mar. 1991, coll. M. Murano. 12 males (2.8–3.1 mm) and 11 females (2.6–3.1 mm), Shiraho, Ishigaki Island, hand net, 2 m, 6 July 1999, coll. K. Fukuoka.

Remarks

The telson and the fourth pleopod of the male are variable in morphology. In Ogasawara and Aka-jima specimens a sexual dimorphism in the telson was observed. The apical cleft of the telson in the female is deeper than that in the male: 1/4 of the telson length in the male while 1/3 of the telson length in the female in Ogasawara specimens (Fig. 1I, J), and 1/3 of the telson length in the male while slightly less than half of the telson length in the female in Aka-jima specimens (Fig. 1K, L). The anterior end of the cleft is at the level of the base of the third or fourth lateral spine counted from the apical one in the male, while at the level of the base of the third, fourth or fifth lateral spine in the female. The lateral margin of the telson is unarmed on the proximal 1/2–2/3 in the male, whereas it is unarmed on the proximal 1/3–3/5 in the female. On the other hand, Ishigaki specimens do not show such dimorphism in the telson (Fig. 1M, N) and are slightly different from Ogasawara and Aka-jima specimens as follows. (1) The telson is cleft apically 1/5–1/4 of the telson length. (2) The anterior end of the cleft is at the level of the base of the second, third or fourth lateral spine. A variation is also observed in the exopod of the male fourth pleopod in the present specimens; its third segment varies from 1.1 times to 1.8 times as long as the second segment.

Geographical distribution

This species has been recorded from Palau Islands (Ii 1964); Tanabe Bay, Wakayama (Valbonesi & Murano 1980); Great Barrier Reef (Carleton & Hamner 1989); Aka-jima Island, Okinawa (Murano 1990); Suzaki, Kochi; Iye Island, Okinawa (Ohtsuka et al. 1995); Ishigaki Island, Okinawa; and Ogasawara Islands (present study). Thus, this species is widely distributed in temperate to tropical regions of the western Pacific Ocean.

Anisomysis ryukyuensis Murano, 1990

Anisomysis ryukyuensis Murano, 1990, p. 205–207, Fig. 14.—Müller, 1993, p. 206 (list).

Materials

Abundant males (up to 7.2 mm) and females (up to 7.0 mm), Motobu, Okinawa, 9 Jan. 1986, provided by Okinawa Expo Aquarium. Abundant males (adult: 3.5–7.0 mm) and females (adult: 3.5–7.0 mm), Manazuru, Kanagawa, sledge net, 0.3 m, 7–8 Aug. 1990, coll. K. Fukuoka. 2 males (5.8 and 6.8 mm) and 1 female (8.6 mm), Yaene Harbor, Hachijo-jima Island, Izu Islands, surface tow with plankton net under a light at night,

22 June 1995, coll. K. Fukuoka. 1 male (5.6 mm) and 1 female (5.8 mm), near Sonai, Iriomote Island, Okinawa, hand net, 1 m, 4 Apr. 1997, coll. K. Fukuoka.

Remarks

Anisomysis ryukyuensis is closely allied to *A. enewetakensis*. Differences between these two species include the length of the antennal scale, the shape of the second segment of the mandibular palp, the length ratio of the second and third segments of the male fourth pleopod, and the shape of the telson (Murano 1990). The present specimens of *A. ryukyuensis* show a variation in the exopod of the male fourth pleopod. In some individuals the second segment of the exopod is longer than the third, but in others it is shorter than the third, as seen in *A. enewetakensis*. In the specimens collected from Hachijo-jima Island, the antennal scale is similar to that of *A. enewetakensis* in length. These two characters, therefore, cannot be used to distinguish *A. ryukyuensis* from *A. enewetakensis*.

Geographical distribution

Anisomysis ryukyuensis was recorded from Aka-jima Island, Okinawa (Murano 1990). The present study extends the distributional range of this species east- and northeastward. The occurrence from Manazuru, Kanagawa, is the first record from Honshu, the mainland of Japan.

Anisomysis thurneysseni Nouvel, 1973 (Fig. 1O, P)

Anisomysis thurneysseni Nouvel, 1973, p. 1453–1458, Figs 1–20.—Mauchline & Murano, 1977, p. 47 (list).—Müller, 1993, p. 207 (list).

Materials

17 males (2.4–3.2 mm), 3 immature males (2.0–2.4 mm), 32 females (2.5–3.2 mm) and 9 immature females (1.9–2.6 mm), Tasman Sar, Pejamantan Bay, Bali Island, Indonesia, sandy beach, 4 Dec. 1996, coll. Y. Ogawa and Y. Hanamura.

Remarks

The present specimens agree morphologically with the type specimens except for the length of the male fourth pleopod. In the present specimens the exopod of the male fourth pleopod extends posteriorly beyond the base of the telson (Fig. 1O), whereas it does not overreach the middle of the last abdominal somite in the type specimens.

Nouvel (1973) described the denticles of the lateral margins of the telson as never articulated at the base, and observed irregular size and arrangement of the apical spines of the telson. However, in the present specimens, the lateral spines of the telson are indistinctly articulated and the apical spines are arranged regularly (Fig. 1P).

Geographical distribution

This species has only been recorded from the Gulf of Citrons, Noumea, New Caledonia (Nouvel 1973). The present occurrence from Bali Island, Indonesia, is the second record.

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