Crustacean Research 2018 Vol.47: 137–143

 doi: 10.18353/crustacea.47.0_137

First record of *Pleurerythrops secundus* (Crustacea, Mysida) in association with benthic hydroids (Cnidaria, Hydrozoa) in shallow waters of Izu-Ohshima, Pacific coast of central Japan

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Abstract.— The erythropini mysid, *Pleurerythrops secundus* Murano, 1970, is recorded in shallow waters of the northeastern coast of Izu-Ohshima Island, Pacific coast of central Japan. Underwater surveys at a depth of 15–30 m by a scuba diver revealed that *P. secundus* lived on the benthic hydroids *Aglaophenia whiteleggei* Bale, 1888, *Dentitheca hertwigi* (Stechow, 1909), *Gymnangium hians* (Busk, 1852), *Plumularia habereri* Stechow, 1909, and several unidentified hydroid species. This finding represents the first evidence of *P. secundus* associated with benthic organisms. Furthermore, to the best of our knowledge, this is the first report of a mysid species in association with hydrozoans.

Key words*: coloration, Erythropini, Peracarida, shallow waters, symbiosis, underwater observations*

Mysid crustaceans are members of marine zooplankton (Mauchline, 1980). Some species live in association with benthic invertebrates such as sponges, sea anemones, corals, and hermit crabs, although most are free-living and inhabit the near-bottom layer (Mauchline, 1980; Fukuoka, 2004). The second author, OH, has made several new records of small marine animals by underwater observation during scuba diving (Uyeno & Nagasawa, 2010, 2012; Saito & Hoshino, 2011, 2015, 2017; Ota *et al*., 2012; Saito, 2012, 2015; Yamada & Hoshino, 2014; Saito *et al*., 2014; Uyeno, 2015; Hoshino & Saito, 2016; Shimomura, 2016, 2017; Shimomura & Hoshino, 2017; Okuno, 2017). Recently, he found mysids attached to several species of hydroids (Cnidaria). Herein, we report the association and behavior of mysids and hydroids.

Mysids on hydroids were observed in shallow waters off "Aki-no-hama" (34°47′14″N, 139°24′32″E), the northeastern coast of Izu-Ohshima Island, Pacific coast of central Japan. Surveys were conducted at a depth of 15–30 m almost every day by scuba diving from March 2015 to August 2017 (Table 1). The water temperature in the bottom layer ranged from approximately 13.0°C to 27.0°C. Colonies of hydroids were investigated for attached mysids at 10 sites per day; a total of 23 sites were surveyed during the study period. Mysids associated with hydroids were photographed with an underwater camera set (camera, Nikon D810; camera lens, Nikon AF Micro Nikkor 105 mm; camera housing, Nexus D810). The number of mysid individuals was counted using the photographic records. For taxonomic identification, several individuals were collected, frozen temporally in the laboratory, and then preserved in 70% ethanol. Morphological observations and measurements were made with the aid of a binocular microscope (Olympus X-II) and a compound microscope (Olympus BHB-Tr). Body length (BL) was measured from the tip of the rostrum to the posterior end of the telson, excluding spiniform setae, along the dorsal mid line. Other measurements and terminology followed those of Murano (1997). The examined specimens were deposited in the National Museum of Nature and Science

Received: 7 Sept 2018. Accepted: 29 Oct 2018. Published online: 7 Dec 2018.

Table 1. Occurrence of *Pleurerythrops secundus* in association with hydroids in the shallow water of Izu-Ohshima Island from March 2015 to August 2017.

Year	Month	Number of days		Number of sites that mysids occurred	Individuals/ sites	Individuals/ month	Hosts
		Surveyed	Mysids occurred				
2015	March	29	1	1	1	1	*Aglaophenia whiteleggei*
	April	28	3	3	1–2	5	*Dentitheca hertwigi* *Gymnangium hians* unidentified hydroids
	May	27	1	1	4	4	*Aglaophenia whiteleggei*
	June	26	0	0	0	0	
	July	28	1	1	1	1	unidentified hydroids
	August	27	0	0	0	0	
	September	23	0	0	0	0	
	October	24	0	0	0	0	
	November	24	0	0	0	0	
	December	28	0	0	0	0	
2016	January	28	0	0	0	0	
	February	24	0	0	0	0	
	March	24	0	0	0	0	
	April	27	0	0	0	0	
	May	27	0	0	0	0	
	June	27	0	0	0	0	
	July	30	0	0	0	0	
	August	22	0	0	0	0	
	September	27	0	0	0	0	
	October	24	0	0	0	0	
	November	23	0	0	0	0	
	December	25	1	1	1	1	unidentified hydroids
2017	January	21	1	1	1	1	*Gymnangium hians*
	February	24	1	1	1	1	*Dentitheca hertwigi*
	March	25	0	0	0	0	
	April	24	8	6	1–3	21	*Dentitheca hertwigi* *Plumularia habereri* unidentified hydroids
	May	31	9	4	1–8	38	*Dentitheca hertwigi* unidentified hydroids
	June	29	7	7	1–4	13	*Dentitheca hertwigi* unidentified hydroids
	July	30	8	6	1–8	21	*Dentitheca hertwigi* *Plumularia habereri* unidentified hydroids
	August	28	6	3	1–1	6	unidentified hydroids

(NSMT), Tsukuba, Japan.

In the present study, two specimens, one male (3.91 mm BL, NSMT-Cr 25855) and one ovigerous female (3.88 mm BL, NSMT-Cr 25856) (Fig. 1A, B), were examined in the laboratory. Morphological characteristics of both the specimens were consistent with those of *Pleurerythrops secundus* Murano, 1970 (Mysidae, Erythropinae, Erythropini): 1) the endopod of pleopod 5 longer than the exopod in male, and with a modified naked stout setae subequal to the length of endopod on the ultimate and

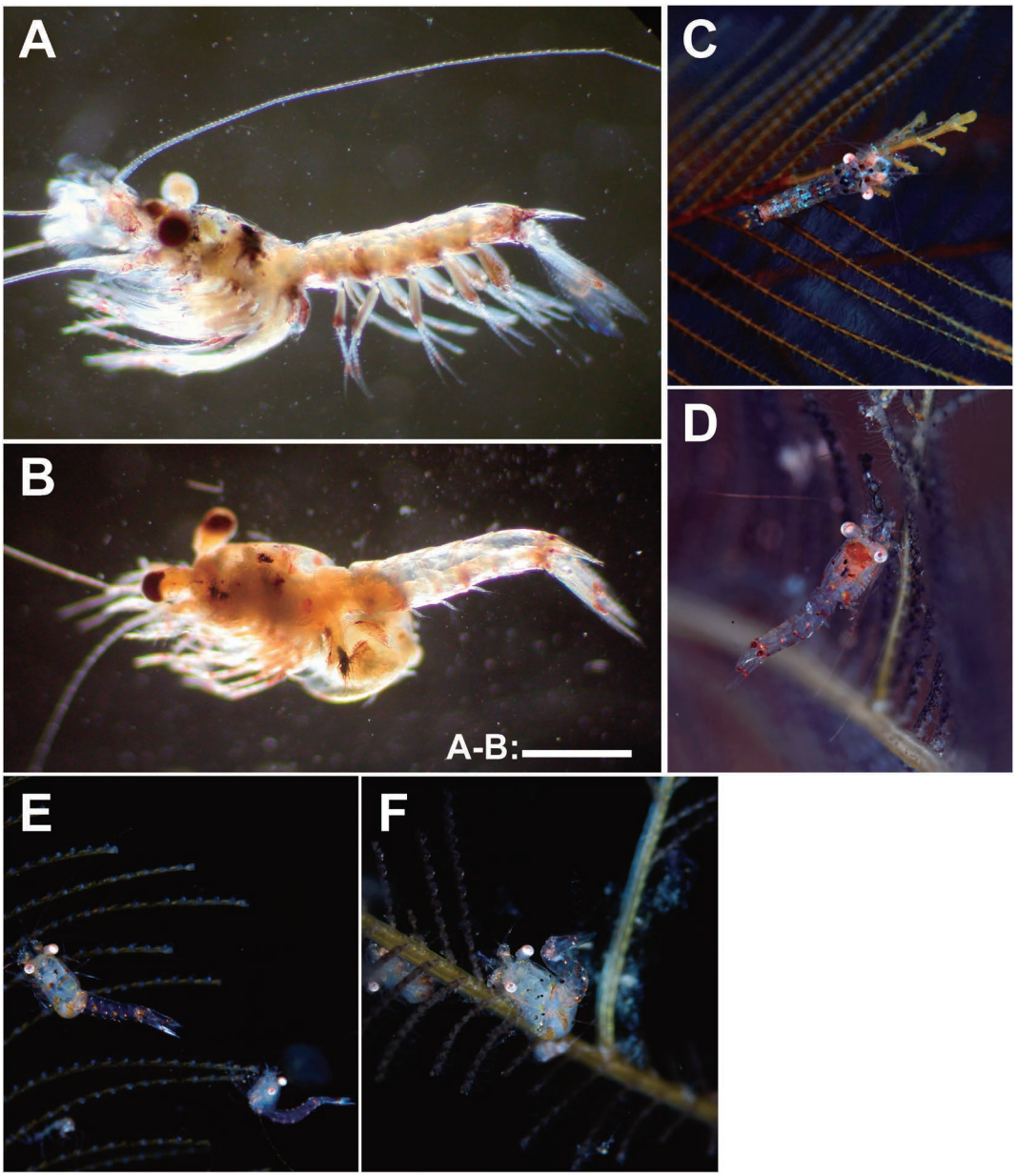

Fig. 1. *Pleurerythrops secundus* attached to some hydroid species in shallow water off "Aki-no-hama", Izu-Ohshima, Pacific coast of central Japan. A, C, male (3.91 mm BL), NSMT-Cr 25855, 13 January 2017, 25 m depth, host: *Gymnangium hians*; B, E, ovigerous female (3.88 mm BL), NSMT-Cr 25856, 8 June 2017, 25 m depth, host: *Dentitheca hertwigi*; D, a specimen, 20 April 2017, 26 m depth, host: *D. hertwigi*; F, a specimen, 16 July 2017, 27 m depth, host: *D. hertwigi*. Scale bar = 1 mm.

penultimate segments and 2) the inner pair of spiniform setae on the narrow apex of telson straight and slender. *Pleurerythrops secundus* has been recorded from Suruga Bay (Murano, 1970, 1981), the Ariake Sea (Murano, 1981), Omura Bay (Murano, 1981), and the East China Sea (Murano, 1981). Therefore, the present occurrence of *P. secundus* slightly extends the distributional range of this species eastward.

The genus *Pleurerythrops* comprises five

species, *P. americanus* Zoppi de Roa & Delgado, 1989, *P. constrictus* Panampunnayil, 1977, *P. inscitus* Ii, 1964, *P. monospinosus* Liu & Wang, 1986, and *P. secundus* (Mees & Meland, 2012), although the affiliation of *P. americanus* is doubtful. The coloration of the *Pleurerythrops* species has not been recorded previously. This might be due to the examination of preserved specimens in fixatives. For the first time, in the present study, we revealed the coloration of *P. secundus* by observing live individuals. Live *P. secundus* is transparent with light brown chromatophores (Fig. 1): brown spots on carapace and female oostegites; dark brown endopods of thoracopods, posterior end of sixth pleonite, basal part of telson, tip of uropodal peduncle, distal end of uropod, and male penis. Cornea of the eye is black.

In the present field observations, *P. secundus* occurred from March to July 2015 and from December 2016 to August 2017 (Table 1). This species was found on the following hydroids: *Aglaophenia whiteleggei* Bale, 1888, *Dentitheca hertwigi* (Stechow, 1909), *Gymnangium hians* (Busk, 1852), *Plumularia habereri* Stechow, 1909, and several unidentified species. The mysids were observed on 47 days at 23 sites with hydroid colonies covering a total area of approximately 6800 m^2. One to eight individuals were attached to a hydroid branch (hydrocaulus) via the thoracic endopods. When disturbed, individuals moved quickly for some distance along a hydroid branch. In some cases, several mysid individuals attached to the

Table 2. Records of mysid species in association with cnidarians except corals.

Species	Host		Literature
Heteromysinae			
Heteromysis actiniae	sea anemone	*Bartholomea annulata*	Clarke (1955); Brattegard (1969, 1974, 1975); Modlin (1987)
	sea anemone	unknown	Brattegard (1970)
Heteromysis bermudensis	sea anemone	*Bartholomea annulata*	Clarke (1955)
Heteromysis mayana	sea anemone	*Bartholomea annulata*	Modlin (1987)
	sea anemone	unknown	Brattegard (1970)
Heteromysis wirtzi	sea anemone	*Telmatactis cricoides*	Wittmann (2008)
Ischiomysis telmatactiphila	sea anemone	*Telmatactis cricoides*	Wittmann (2013)
Ischiomysis peterwirtzi	sea anemone	*Telmatactis cricoides*	Wittmann (2013)
Leptomysinae			
Leptomysis truncata pontica	sea anemone	*Anemonia sulcata*	Wittmann (1978)
Leptomysis truncata truncata	sea anemone	*Anemonia sulcata*	Wittmann (1986)
Leptomysis truncata sardica	sea anemone	*Anemonia sulcata*	Wittmann (1978; 1986)
Leptomysis buergii	sea anemone	*Anemonia sulcata*	Wittmann (1986)
Leptomysis lingvura adriatica	sea anemone	*Anemonia sulcata*	Wittmann (1986)
Leptomysis lingvura lingvura	sea anemone	*Anemonia sulcata*, *Aiptasia mutabilis*	Wittmann (1978)
Metamysidopsis elongata	medusa	*Chrysaora achlyos*	Martin & Kuck (1991)
Mysidopsis cathengelae	medusa	*Chrysaora achlyos*	Martin & Kuck (1991)
Pyroleptomysis rubra	sea anemone	*Anemonia sulcata*	Wittmann (1978)
Mysidellinae			
Mysidella hoshinoi	sea anemone	Haloclavidae sp.	Shimomura (2016)
Mysinae			
Idiomysis inermis	sea anemone	*Stichodactyla haddoni*	Greenwood & Hadley (1982); Bhaduri & Crowther (2016)
Idiomysis tsurnamali	sea anemone	*Megalactis hemprichii*	Bacescu (1973)
	medusa	*Cassiopea andromeda*	Bacescu (1973)

branch of hydroids decreased in number or disappeared on the subsequent observation day. Other invertebrates such as pycnogonids (*Nymphopsis muscosa* Loman, 1908), copepods, amphipods (*Microjassa* sp. and *Caprella californica* Stimpson, 1856), and decapods (*Rapipontonia galene* (Holthuis, 1952)) co-occurred on the hydroids in the observation sites (H. Ariyama, M. Aoki, K. Miyazaki, personal communications for taxonomic identifications).

Eighteen mysid species and subspecies belonging to the subfamilies Heteromysinae, Leptomysinae, Mysidellinae, and Mysinae were recorded in association with various cnidarians, except corals (Table 2). Most of these species are associated with sea anemones. Furthermore, *Idiomysis tsurnamali* Bacescu, 1973 was observed hovering over the scyphozoan medusa *Cassiopea andromeda* (Forsskål, 1775) (Bacescu, 1973). Martin & Kuck (1991) also reported two species, *Metamysidopsis elongata* (Holmes, 1900) and *Mysidopsis cathengelae* Gleye, 1982, from the washing of the scyphozoan medusa *Chrysaora achlyos* Martin, Gershwin, Burnett, Cargo & Bloom, 1997 collected from inshore water, although it was not clear whether the occurrence was due to symbiosis or contingency. To the best of our knowledge, the present study is the first report of mysids associated with hydroids. Most mysid associates of cnidarians form a loose relationship with their host species, swimming around the body of the host without contacting it (Bacescu, 1973; Greenwood & Hadley, 1982; Wittmann, 1986, 2008, 2013; Bhaduri & Crowther, 2016). *Heteromysis actiniae* Clarke, 1955 and *Mysidella hoshinoi* Shimomura, 2016, mysid symbionts of the sea anemone *Bartholomea annulata* (Le Sueur, 1817) and unidentified species of Haloclavidae, respectively (Clarke, 1955; Brattegard, 1969, 1974, 1975; Modlin, 1987; Shimomura, 2016), settle or sometimes perch on the tentacles (Clarke, 1955; Shimomura, 2016). In the present study, *P. secundus* was usually found attached to branches of hydroids when observed underwater.

Pleurerythrops secundus was collected from near-bottom layers at depths of 28–240 m by beam-trawl, bottom-net, and sledge (Murano, 1970, 1981); however, it is not known whether this mysid species lives in contact with bottom sediments and benthic organisms. The present finding by underwater observation is the first record of *P. secundus* in association with hydroids.

Acknowledgments

We thank Drs. Hiroyuki Ariyama (Osaka Museum of Natural History), Masakazu N. Aoki (Tohoku University), and Katsumi Miyazaki (Niigata University), for identification of co-occurring marine animals. We sincerely thank Dr. Kaori Wakabayashi (Hiroshima University) for making helpful suggestions concerning early drafts of this paper. Thanks are also extended to two anonymous reviewers for their useful comments on this manuscript.

Literature Cited

Bacescu, M., 1973. A new case of commensalism in the Red Sea: the mysid *Idiomysis tsurnamali* n. sp. with the Coelenterata *Megalactis* and *Cassiopea*. Revue Roumaine de Biologie – Zoologie, 18: 3–7.

Bhaduri, R. N., & Crowther, A. L., 2016. Association of the mysid *Idiomysis inermis* with the sea anemone *Stichodactyla haddoni* in Moreton Bay, Australia. Marine Biodiversity, 46: 707–711.

Brattegard, T., 1969. Marine biological investigations in the Bahamas 10, Mysidacea from shallow water in the Bahamas and southern Florida, part 1. Sarsia, 39: 17–106.

Brattegard, T., 1970. Mysidacea from shallow water in the Caribbean Sea. Sarsia, 43: 111–154.

Brattegard, T., 1974. Mysidacea from shallow water on the Caribbean coast of Panama. Sarsia, 57: 87–108.

Brattegard, T., 1975. Shallow-water Mysidacea

from the Lesser Antilles and other Caribbean regions. Studies on the Fauna of Curaçao and other Caribbean Islands, 47: 102–115.

Clarke, W. D., 1955. A new species of the genus *Heteromysis* (Crustacea, Mysidacea) from the Bahama Islands, commensal with a sea-anemone. American Museum Novitates, 1716: 1–13.

Fukuoka, K., 2004. A new species of *Heteromysis* (Mysida, Mysidae) associated with sponges, from the Uraga Channel, central Japan, with notes on distribution and habitats within the genus *Heteromysis*. Crustaceana, 77: 1353–1373.

Greenwood, J. G., & Hadley, D. J., 1982. A redescription of the mysid *Idiomysis inermis* Tattersall, 1922 (Mysidacea) to include the previously unknown female. Crustaceana, 42: 174–178.

Hoshino, O., & Saito, N., 2016. Note on a SCUBA observation in a field of mother-young association of an arcturid isopod. Umiushi-tsushin, 90: 5. (In Japanese)

Martin, J., & Kuck, H., 1991. Faunal associates of an undescribed species of *Chrysaora* (Cnidaria, Scyphozoa) in the Southern California Bight, with notes on unusual occurrences of other warm water species in the area. Bulletin of the Southern California Academy of Sciences, 90: 89–101.

Mauchline, J., 1980. The biology of mysids. Advances in Marine Biology, 18: 1–369.

Mees, J., & Meland, K. (Eds.), 2012 onwards. World List of Lophogastrida, Stygiomysida and Mysida. Erythropini Hansen, 1910. Accessed through: World Register of Marine Species at: http://marinespecies.org/aphia.php?p=taxdetails&id=148709 on 2018-04-12

Modlin, R. F., 1987. Mysidacea from shallow waters in the vicinity of Carrie Bow Cay, Belize, Central America, with descriptions of two new species. Journal of Crustacean Biology, 7: 106–121.

Murano, M., 1970. A small collection of benthic Mysidacea from coastal waters in Suruga Bay, Japan. Crustaceana, 18: 251–268.

Murano, M., 1981. Mysidacea from the central and western Pacific. V. Genera *Heteroerythrops*, *Meierythrops*, *Pleurerythrops*, *Gibberythrops*, *Illigiella*, *Dactylamblyops*, *Pseudamblyops*, *Paramblyops*, *Dactylerythrops* and *Nakazawaia* (tribe Erythropini). Publications of the Seto Marine Biological Laboratory. 26: 261–302.

Murano, M., 1997. Mysidacea. In Chihara, M, & Murano, M. (eds.), An illustrated guide to marine plankton in Japan, pp.xiv–xv + 1010–1084. Tokai Univ. Press., Tokyo. (In Japanese)

Okuno, J., 2017. Designation of a new genus *Michaelimenes* (Decapoda: Caridea: Palaemonidae), with new host record and range extension of its type species, *M. perlucidus* (Bruce, 1969). Nauplius, 25: 1–12.

Ota, Y., Hoshino, O., Hirose, M., Tanaka, K., & Hirose, E., 2012. Third-stage larva shifts host fish from teleost to elasmobranch in the temporary parasitic isopod, *Gnathia trimaculata* (Crustacea; Gnathiidae). Marine Biology, 159: 2333–2347.

Saito, N., 2012. A new species of cirolanid isopod, *Eurydice nunomurai* (Crustacea) from Izu-Ohshima Island, Sagami Sea, Pacific coast of central Japan. Crustacean Research, 41: 19–25.

Saito, N., 2015. A new hemiarthrine bopyrid, *Izuohshimaphryxus hoshinoi* (Crustacea: Isopoda) from Izu-Ohshima Island, Sagami Sea, Pacific coast of central Japan. Crustacean Research, 44: 67–73.

Saito, N., & Hoshino, O., 2011. Ecological notes on the infaunal mysid, *Heteromysis komaii* Fukuoka, 2004 (Crustacea: Mysida: Mysidae), associated with sponges *Callyspongia confoederata* (Ridley, 1884) from Izu-Ohshima Island, Sagami Sea, central Japan. Natural History Report of Kanagawa, 32: 51–54. (In Japanese with English abstract)

Saito, N., & Hoshino, O., 2015. Descriptions of immature stages of Cymothoidae (Crustacea: Isopoda) collected from Izu-Ohshima, Pacific coast of central Japan. Cancer, 24: 53–62.

(In Japanese with English abstract)

Saito, N., & Hoshino, O., 2017. Record of Cymothoidae (Crustacea: Isopoda) infecting buccal cavity of *Trimma okinawae* collected from Izu-Ohshima, Japan. Cancer, 26: 21–24. (In Japanese)

Saito, N., Yamauchi, T., Ariyama, H., & Hoshino, O., 2014. Descriptions and ecological notes of free-swimming forms of cymothoid isopods (Crustacea: Peracarida) collected in two waters of Japan. Crustacean Research, 43: 1–16.

Shimomura, M., 2016. *Mysidella hoshinoi*, a new species from Izu-Oshima Island, Japan (Crustacea, Mysidae, Mysidellinae). ZooKeys, 620: 21–32.

Shimomura, M., 2017. A new species of *Aspidophryxus* (Isopoda, Dajidae), ectoparasitic on *Mysidella hoshinoi* (Mysidae) in Japan. ZooKeys, 646: 109–118.

Shimomura, M., & Hoshino, O., 2017. Field observation of the ectoparasitic isopod *Aspidophryxus izuensis* Shimomura, 2017 (Dajidae) in Izu-Oshima Island. Cancer, 26: 25–30. (In Japanese)

Uyeno, D., 2015. Systematic revision of the pennellid genus *Creopelates* Shiino, 1958 (Copepoda: Siphonostomatoida) and the proposal of a new genus. Zootaxa, 3904: 359–386.

Uyeno, D., & Nagasawa, K., 2010. Three new species of the family Pennellidae (Copepoda: Siphonostomatoida) from gobiid fishes (Actinopterygii: Perciformes) in coastal waters of the western Pacific Ocean. Zootaxa, 2687: 29–44.

Uyeno, D., & Nagasawa, K., 2012. *Ttetaloia hoshinoi*, a new genus and species of chondracanthid copepod (Poecilostomatoida) parasitic on triplefins (Actinopterygii: Tripterygiidae) from Japanese waters. Zoosymposia, 8: 39–48.

Wittmann, K. J., 1978. Biotop- und Standortbindung meditettaner Mysidacea. 211 pp. Dissertation zur Erlangung des Doktorgrades an der Formal- und Naturwissenschaftlichen Fakultät der Universität Wien.

Wittmann, K. J., 1986. Untersuchungen zur Lebensweise und Systematik von *Leptomysis truncata* und zwei verwandten Formen (Crustacea, Mysidacae). Annalen des Naturhistorischen Museums in Wien, 87B: 295–323, Taf. 1.

Wittmann, K. J., 2008. Two new species of Heteromysini (Mysida, Mysidae) from the island of Madeira (N.E. Atlantic), with notes on sea anemone and hermit crab commensalisms in the genus *Heteromysis* S. I. Smith, 1873. Crustaceana, 81: 351–374.

Wittmann, K. J., 2013. Mysids associated with sea anemones from the tropical Atlantic: Description of *Ischiomysis* new genus, and two new species in this taxon (Mysida, Mysidae, Heteromysinae). Crustaceana, 86: 487–506.

Yamada, K., & Hoshino, O., 2014. *Esperiopsis plumosa* Tanita 1965 (Esperiopsidae, Demospongiae) declined by a commensal polychaete *Polydorella dawydoffi* Radashevsky 1996 (Spionidae), Izu Oshima Island, Japan. Bulletin of the Biogeographical Society of Japan, 69: 189–191. (In Japanese with English abstract)

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