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Biological notes on *Makassaritanais itoi* (Ishimaru, 1985) (Crustacea: Peracarida: Tanaidacea)

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Abstract

Through observations of captive individuals, this study confirmed that *Makassaritanais itoi* (Ishimaru, 1985) is a protogynous hermaphrodite and dwells in tubes. Seven of ten isolated females changed sex and three did not, implying that *M. itoi* may consist of hermaphrodites and gonochoristic females, as has been suggested for other protogynous hermaphroditic tanaidaceans.

Key words: Leptocheliidae; protogyny; sequential hermaphroditism; sex change; silk; tube

Makassaritanais itoi (Ishimaru, 1985) is a leptocheliid tanaidacean originally described from Oshoro Bay, Hokkaido, Japan. The original description (Ishimaru 1985: p. 241) stated that "[*M. itoi*] is proved to be a protogynous potential hermaphrodite by field observations and rearing experiments (Ishimaru, unpublished)," but no further information has been provided until now. Leptocheliidae, to which *M. itoi* belongs, contains several species for which the capability to construct tubes has been confirmed (Kakui 2021). *Makassaritanais itoi* was thus highly likely to be a tube-dweller, but this remained unconfirmed. Here I report on the sexual system and mode of life in *M. itoi*, based on rearing experiments.

Tanaidaceans were collected by the RV *Oyashio III* (Oshoro Marine Station, Hokkaido University) with an Ekman-Birge grab at about 8 m depth in Oshoro Bay on 7 October 2024. Tanaidaceans obtained were kept in the laboratory (20 °C; 14 hr light / 10 hr dark) in a small aquarium that contained sand from their sampling site and were fed every 2–4 days with porphyrized dry feed for crayfish (Kyorin, Japan) and Easybooster NANO (Easy Reefs, Spain). Four females (Females 1–4) and two males were isolated on 15 December 2024, and six females (Females 5–10) on 2 January 2025. Each isolated individual was placed in one well of a 6-well cell-culture plate kept at the temperature and conditions described above, was fed every 2–4 days, and was observed daily with a NIKON SMZ-10 stereomicroscope to check: (1) the presence/absence of an exuvia; and if an exuvia was observed or the individual was outside its tube, (2) the sex of the individual (based on external morphology; cf. Ishimaru 1985).

Table 1 summarizes the results of rearing the isolated individuals. Seven females (Fig. 1A, a, B, b) molted once and changed sex 1–13 days after isolation; as Female 7 did not take its exuvia outside its tube, the time of molting was unclear. Females 1, 2, and 5 did not change sex. Female 1 died on the day it molted. Female 2 molted twice and died 11 days after the second molt, after which the female had a fully developed, empty brood pouch and well-developed ova in size. Female 5 initiated molting but failed to complete it and was fixed a day later. Ova were not observed in this female 11 days before molting (Fig. 1C), were moderately developed 5 days before molting (Fig. 1D, arrow), and were well developed when molting (Fig. 1E, arrow). Two males died without any molting.

Captive individuals constructed tubes in the bottom

Table 1. Summary of the rearing experiment. Bold font indicates individuals that changed sex. Abbreviations: dsi, days subsequent to isolation; (+) changed sex; (–) did not change sex. † Molt initiated but failed, not completed. * Date of fixation of the living individual.

Individual	Time of molt (dsi)	Time of death (dsi)
Female 1	1 (–)	1
Female 2	8 (–)	
	16 (–)	27
Female 3	13 (+)	13*
Female 4	2 (+)	2*
Female 5	11† (–)	12*
Female 6	2 (+)	2*
Female 7	3–5 (+)	5*
Female 8	3 (+)	3*
Female 9	5 (+)	5*
Female 10	1 (+)	1*
Male 1		3
Male 2		2

sediment, showing that *M. itoi* is a tube-dweller and that this is a rapid process, as within 3 hours a female made a tube more than twice as long as its body (Fig. 1F–H). In the small aquarium containing *M. itoi* individuals and covered with a thick sand layer, I found many tubes beneath the sand surface.

I confirmed that *M. itoi* females can change sex isolated under captive conditions, although of ten females, three did not change sex during the experimental period. As mentioned above, Female 2 molted twice and died 11 days after the last molt. This implies that hermaphrodites that can change sex from female to male, as well as gonochoristic females that cannot change sex, occur in *M. itoi*, as has been suggested for the leptocheliid *Heterotanais oerstedii* (Krøyer, 1842) and the nototanaid *Nesotanais* sp. aff. *ryukyuensis* Kakui, Kajihara, and Mawatari, 2010 (Bückle-Ramírez 1965; Kakui and Hiruta 2022).

This study was preliminary and may not be conclusive, as it did not include body-size measurements typically made for tanaidaceans, internal morphology was not observed, whether sex-changed males are functional (i.e., capable of producing sperm that can fertilize eggs) was not checked, and the rearing experiments included only a few isolated individuals. The descendants of individuals collected on 7 October 2024 have been maintained to the present day (14 February 2025) and form the basis for a successful laboratory strain of *M. itoi*. Little is known about the mechanism of sex change in Tanaidacea, and this laboratory strain will allow in-depth investigation of this phenomenon.

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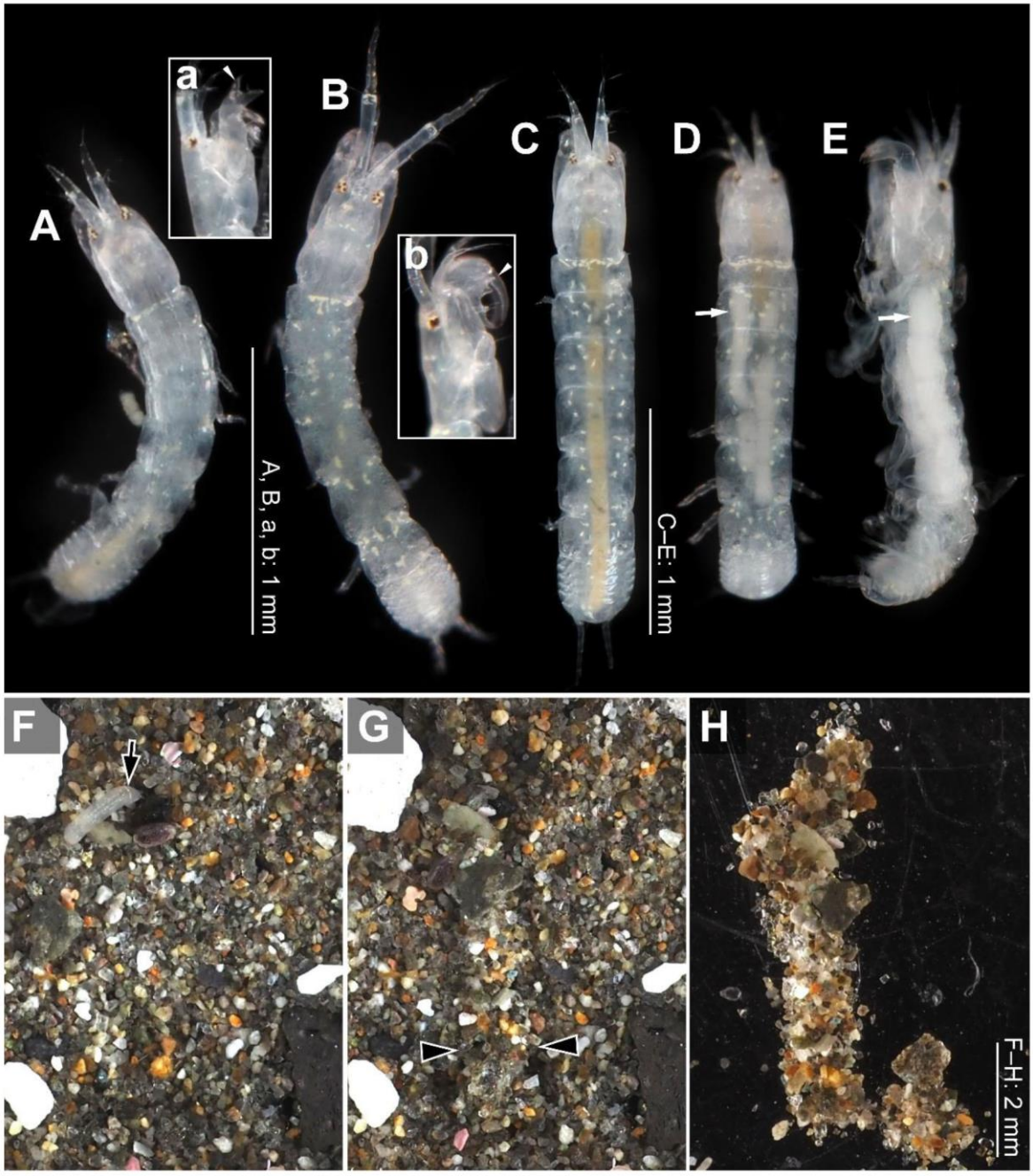

Fig. 1. *Makassaritanais itoi* (Ishimaru, 1985): A–E, living individuals; F–H, tube construction by a single female. A, B, habitus of Female 6: female phase photographed 2 days before molting (A); male phase photographed on the day of molting (B). a, b, anterior end of Female 6 in female and male phases, photographed on the same days as A and B (white arrowheads, chelipedal dactylus). C–E, habitus of Female 5, photographed 11 days (C) and 5 days (D) before molting, and 1 day after initiating molt, with unsuccessfully shed exuvia observed (E) (white arrows, ovum). F, G, sequence of tube construction by a single female in a petri dish with a thin layer of sand on the bottom: initiation of the construction (F) and 3 hrs later (G) (black arrow, the female; black arrowheads, outer edges of the tube). H, the tube 3 hrs later, after the removal of surrounding sand particles.

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