

Note

Infertility of the planktonic copepod *Calanus sinicus* caused by parasitism by a larval epicaridian isopod

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Planktonic copepods are known to serve as intermediate hosts for epicaridian isopods parasitic on marine decapod crustaceans (Gnanamuthu & Krishnaswamy 1948; Marshall & Orr 1955; Anderson 1975). In this paper, we report for the first time infertility in copepods caused by parasitism by a larval epicaridian isopod.

Parasitic isopods of the suborder Epicaridea develop through three larval stages, i.e. epicaridium, microniscus and cryptoniscus, before reaching the adult stage, which is typically found on decapod crustaceans living on the sea floor (Hiraiwa 1936; Veillet 1945). Although the final hosts are castrated through parasitism by the adult epicarids (Anderson 1977; Beck 1979), the effects of larval epicarids upon the reproduction of their copepod intermediate hosts are yet to be investigated. Marshall & Orr (1955), however, noted that the ovaries of *Calanus finmarchicus* were often undeveloped when it was parasitized by an isopod. During our study of the in situ egg production rate of *Calanus sinicus* in relation to phytoplankton availability in the Inland Sea of Japan (Uye & Murase 1997), parasitized females were occasionally discovered in the plankton samples. We examined the egg production rate of the infected *C. sinicus* individuals.

Three or four *C. sinicus* females parasitized by a larval epicaridian isopod were collected at three stations in the following sub-areas of the Inland Sea of Japan, i.e. Harima Nada (June 1994), Suo Nada (June 1995) and Aki Nada (September

1995), and were incubated individually in vials containing 105 μm -mesh-filtered seawater from the sampling site for 24 h (see Uye & Murase 1997 for detailed method). Thirteen to 19 non-parasitized females were also incubated as controls. Results are outlined in Fig. 1. The infected *C. sinicus* individuals produced extremely few eggs; the mean egg production rate varied from 0 to 0.7 eggs female⁻¹ d⁻¹. The mean egg production rate for the control females ranged from 11.3 to 26.8 eggs female⁻¹ d⁻¹.

The life cycle of epicaridian isopods is as follows (cf. Cheng 1964). The first larval stage, or epicaridium, is liberated from the adult and actively swims in order to attach itself to planktonic copepods. After attaching to a copepod, the epicaridium metamorphoses into the second stage, or microniscus. After extensive growth on the copepod, the parasite develops into the final larval stage, or cryptoniscus, and soon leaves the first host to become attached to the second host. Based on the work of Veillet (1945) and Anderson & Dale (1981), larval isopods removed from the carapace of *C. sinicus* were identified as the late microniscan stage of the suborder Epicaridea. The mean body length was 870 μm (range: 720–1030 μm) and mean body width was 293 μm (range: 270–315 μm). The length of the second antenna was approximately 1/3 body length (Fig. 2).

Infertility of copepods was perhaps induced by removal of host hemolymph by the microniscus,

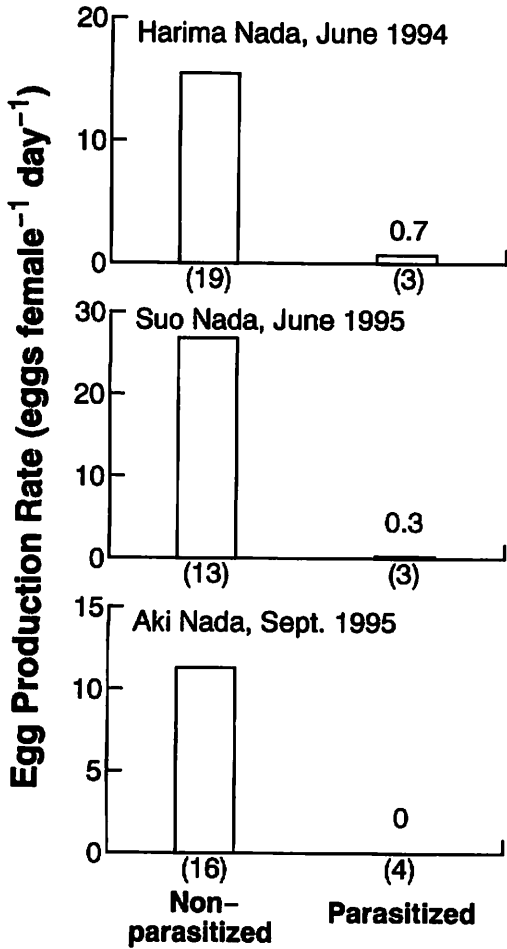


Fig. 1. Effect of parasitism by larval epicarid isopods on the egg production rate of the planktonic copepod *Calanus sinicus* from Harima Nada, Suo Nada and Aki Nada, the sub-areas of the Inland Sea of Japan. Numbers in parentheses are the number of females used in each experiment.

which has a considerably higher food demand in order to meet its higher metabolic and growth rates compared to those of the other larval stages (Anderson 1975; Anderson & Dale 1981). Thus, for an individual copepod, parasitism by a larval epicarid isopod has a significant impact on its reproductive ability. The ecological importance of this parasitic sterilization, however, is apparently insignificant to the host population, because the percentage of parasitized copepods was always negligible. For example, parasitized individuals comprised no more than 0.6% of *C. sinicus* females taken at 8 stations in Hiroshima Bay and Iyo Nada in October 1996 and January 1997.

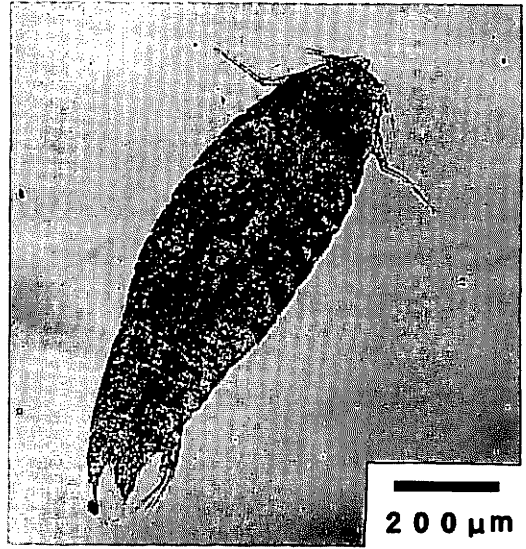


Fig. 2. Light micrograph of an unknown species of larval epicarid isopod; a parasite of the planktonic copepod *Calanus sinicus*.

We found that both sexes of *Acartia omorii*, *A. erythraea*, *Centropages abdominalis*, *C. tenuiremis*, *Oithona davisae* and *Paracalanus* sp., occurring in the Inland Sea of Japan, also serve as hosts for larval epicaridian isopods. The taxonomy of the epicaridian isopods from this area remains to be studied.

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