学 位 論 文 の 要 旨

論文題目　Host preference of the ectoparasitic isopod *Tachaea chinensis* among freshwater shrimps

(外部寄生性等脚類エビノコバンの宿主選択性)

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Research summary

Caridean shrimps represent an important constituent of many estuarine and freshwater habitats. While many species are native, others being anthropogenically introduced to new habitats accidentally or via trades. They are used as fishing baits and as pet in the ornamental industries. The shrimp *Palaemon sinensis,* a species native to China, was accidentally introduced to the ecosystem through their use as fishing baits by the fishermen. Despite the ecological risks imposed by shrimp's habitat relocation, little is known about the effects excreted on shrimp's host-parasite relationship and parasite distribution. The isopod *Tachaea chinensis* (Family: Corallanidae), is an example of an ectoparasite infesting both shrimps and prawns in Eastern Asian countries. They are often found attached to the lateral side of hosts carapace presumably preying on the host during immature stages. Previous research had focused on Caridean shrimps' distribution and/or *Tachaea chinensis* localities, however, little is known about the interaction between the two in terms of preference and possible parasite effects on host species. Therefore, this dissertation addresses the host-parasite relationship (e.g., size selection and host specificity) between the isopod *Tachaea chinensis* and its

associated host shrimps by means of examining wild specimens and conducting laboratory pairwise choice experiments. This study also investigated the possible effects caused by the isopod on the common lake prawn *Palaemon paucidens* growth and reproductive development. Chapter 2 is focused on the establishment of a relationship between the body size of *Tachaea chinensis* and the carapace length of its associated host shrimps. In order to understand the size selection behavior of this isopod in nature, a total of 944 *Palaemon paucidens* and 279 *Neocaridina* spp. were collected from Shiga prefecture, Japan. The size specificity of *Tachaea chinensis* were found different according to body size. Individuals less than 6 mm parasitized both *P. paucidens* (37.5–96.2%) and *Neocaridina* spp. (3.8–62.5%), whereas *T. chinensis* larger than 6 mm were found infesting only *P. paucidens* shrimps. The ratios of the body length of *T. chinensis* to the carapace length of the host shrimp were almost constant (0.8–0.9) with host species and parasite's growth. Indicating that *T. chinensis* tended to attach to host shrimps whom carapace length was slightly larger than its own body length. In chapter 3, the trend of size selection in nature was further elucidated in laboratory conditions, in order to provide a mechanical understanding of the size selection behavior of the isopod. A total of 70 isopods were allowed to select between host shrimps of different size and different species in pairwise selection experiments. Although few isopods did select the smaller option, the parasite showed greater response towards the larger host option. Therefore, when provided with pairs of different host's carapace length, *T. chinensis* may select larger hosts shrimps that are slightly larger than their own body length. *T. chinensis* (≥ 5 mm) were suggested to show size specificity according to the developmental stage. However, Manca staged isopods were seen attached randomly to both large sized and small size *Neocaridina* spp. host shrimps indicating low host specificity of Manca stage *T. chinensis* in laboratory condition. These findings suggests that when large differences, in

carapace length, between host pairs exist, *T. chinensis* express more size selection behavior regardless of the host species.

Chapter 4 is designed to investigate the host species specificity of *T. chinensis* and examine the potential predation on the isopods by host shrimps. In total 13 treatments were conducted in order to clarify the host specificity of the isopod using pairwise choice experiments. These treatments were further subdivided into three groups namely; uncommon hosts, food and shelter and no choice treatments. *T. chinensis* significantly selected the common host shrimp *Palaemon paucidens* between the presented host options. Similar results were observed when a choice between food (e.g., host shrimps) and shelter were offer to the isopod. However, *T. chinensis* selected all of the five hosts options during no choice treatment. This indicates a low host specialization in the isopod *Tachaea chinensis*, which presumably reflect the wide distribution of this species in different freshwater habitats. The results from predation trials showed a significant predation behavior by host shrimps towards the isopod (Fishers exact test, $P < 0.05$). Although all of the tested shrimp were able to consume the isopod the invasive crayfish *Procambarus clarkii* ate greater percentage in significantly shorter time frame (within 1 hour) (Fishers exact test, $P < 0.0001$). Demonstrating an additional destructive behavior of this invasive crayfish on the biodiversity of freshwater habitats. In chapter 5, the growth and the reproductive development of *Palaemon paucidens* in response to parasitism was examined. A total of 360 *Palaemon paucidens* shrimps were examined in this study. Out of which, 170 samples were found infested by *Tachaea chinensis.* Analysis of the gonadosomatic index (GSI) and the hepatosomatic index (HSI) revealed no significant difference in the mean GSI and mean HSI observed between infected and non-infected samples in Shimane prefecture and Okayama prefecture ($P > 0.05$). Similar findings were observed in regards to the mean relative condition factor (K_n) between infected and

non-infected samples. Despite parasitism, egg-bearing females were frequently recorded in this study. This could suggest a more prominent effects might arise in biological aspects of the isopod including; energy utilization, enzyme inhibition, pathogens infection and/or the quantity and quality of developed embryos. It is also possible that the effect may become more obvious in accordance to the length of the infection period. These results concluded minimal effects of *Tachaea chinensis* isopods on the growth and the reproductive development of its associated host shrimp *Palaemon paucidens.*

In conclusion, this study revealed that *Tachaea chinensis* are likely to demonstrate size selection behavior during the initial infestation on host shrimps, however, the fate of advanced stages might be governed by the other factors including; available space, risk of predation and other biotic factors. The host specificity of the isopod is suggested to be low, infecting a broad range of host shrimps. These results comply with previous studies on *Tachaea chinensis*, hypothetically this flexibility in regards to host shrimps' aids in the spread of these isopods in different habitats. In this study, the potential effects on hosts and predation of *Tachaea chinensis* by larger host shrimps were also documented. Providing a better understanding on the host-parasite interactions, which help in further research on the population dynamics of these isopods and hence the establishment of mitigation measures in the future.