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Behaviors of female and male cyclopoid copepod Oithona davisae in relation to foraging and feeding

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Doctoral dissertation summary

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論文題目 Title	Behaviors of female and male cyclopoid copepod *Oithona davisae* in relation to foraging and feeding （キクロプス目カイアシ類 *Oithona davisae* の雌雄別餌探索· 摂餌行動）		

Introduction

For survival and reproduction, adult copepods need to ingest enough prey. Their abilities to encounter, respond to, and capture prey are strongly affected by their swimming, foraging, and feeding behavior. Thus, quantifying the behavior of copepod allows us to reveal the relation of behavior on foraging and feeding. *Oithona davisae* is one of the dominant species in eutrophic waters. It is known that *O. davisae* prefer motile prey by detecting prey-generated hydrodynamic signals. Females ingest more prey than males. However, the relation between sexually different behaviors and prey encounter and ingestion are poorly documented. In this study, I observed how female and male *O. davisae* differ in detecting and ingesting prey. I investigated the relation of behavior on encounter rate and ingestion rate. Then, I explored the sexual differences in behavior as to contributing to different ingestion rates of both sexes.

Materials and methods

It is difficult to observe the continual swimming and feeding process by using restricted observational set-up. Thus, I devised a cinematographic technique, which not only keeps copepod in a relatively natural environment, but also allows three-dimensional motion tracking of copepods for a long time (tens of minutes). The swimming behavior of *Oithona davisae* was observed in a relatively large vessel. The foraging and feeding behavior was observed microscopically in a small flow-cell, to measure the positions of both *O. davisae* and prey *Tetraselmis tetrathele*.

Results and discussion

Oithona davisae detected prey by their antennules while sinking and attacked prey close to their antennules and mouthparts. From behavioral observation, an improved prey encounter model was proposed. Perception volume was estimated from the length of antennules and detection distance. Encounter rate was evaluated from the perception volume, sinking speed, the time spent for sinking, prey swimming speed, and prey density. *O. davisae* can continuously attack prey during a short time and then rest for a long time. They attacked about 20% of encountered prey and captured 40% of attacked prey. This indicates that both encounter rate and success rate for prey capture have impacts on ingestion rate.

The behaviors of both sexes were observed and compared under certain prey densities. Females encountered and ingested more prey than males: (1) females spent more time in searching food; (2) females attacked prey at a longer distance; and (3) females attacked and ingested more prey. On the other hand, males spent most of their time in finding mates by swimming faster and ingesting less. The sexual differences in behavior may be due to males and females having different main missions in reproduction, *i.e.* females require more energy for egg production while males need to search for mates.