



## **Mating behaviour of *Pseudodiaptomus annandalei* (Copepoda Calanoida) with emphasis on rejection rate**

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Mating behaviour has important consequences at both individual and population levels. Reproductive fitness is of paramount importance to sustain the success of planktonic copepod populations in aquatic environments. The calanoid copepod *Pseudodiaptomus annandalei* has one of the largest geographical ranges for Indo-Pacific Pseudodiaptomidae. It is also of great importance in fish culture ponds south of Taiwan. However, the mating behavior of this species has never been studied.

Mating and predatory behaviour are conceptually the same. In both cases, the encounter and the interactions occur between two individuals with opposite characteristics: predator-prey for predation; male-female for mating. The mating behaviour may be defined as a sequence of encounter, pursuit, capture and copulation. Several observed behaviours suggest that both sexes assess and choose among available mates before the copulation. Pre-copulatory mate choice in copepods may manifest as mate guarding where males attached to CV females until their final moult, complicated pre-copulatory dance and escaping. During our preliminary observations, we notice that *P. annandalei* females escape by shaking, often violently, the males that have caught them. Consequently for such a species the act of mating may be visualized as a chain of six events (i.e. search, encounter, pursuit, capture, selective dance, copulation). Within this chain, encounter, capture and copulation are conditional events depending on the successful conclusion of their preceding events in the chain.

In this study, we examined the different step in the mating behaviour of the scarcely studied sub-tropical copepod, *Pseudodiaptomus annandalei*, collected from the Danshuei estuary (North Taiwan). The individuals were observed using a 3D optical system to obtain simultaneous front and side views. Males, when placed in the water where females had previously swum in, showed significant increase of their swimming velocities. Additionally, their swimming trajectories are more convoluted, indicating that males explore larger volume of fluid to increase the probability to encounter a female. The mate finding behaviour appears to depend not only on chemical signal but also on hydromechanical signals. Some males exhibited shifts of direction when females were passing by. When male intercepted a chemical trail left by a female, they initiate tracking behaviour racing up the trail with increasing speed. Males pursued pheromone trails up to 24 sec old and 10 mm long.

Most studies of mating behaviour have focused on detection and sometimes pursuit, but few have addressed the other components of successful mating, namely, capture and copulation. Moreover, mate choice issue has largely been ignored in regards to pelagic copepods. Consequently very few are known about the plasticity of rejection rates as a function of mate encounter rates. The second aim of this experiment is to describe the process used by female to select their mate and to fill the gap in the quantification of mating success. Once caught by a male, *P. annandalei*'s females entered in intensive dance which sometimes lead to shake off the males suggesting a female mate choice. The three-dimensional trajectories described by the couple during this event were characterized by fast loops and intense jumps.

Individual's access to mates may be affected by operational sex ratios, causing strong variation in mating success. We finally manipulated adult sex ratios of the brackish copepod *P. annandalei*, to examine the influence of population sex ratio on mating success of *P. annandalei* in a final set of experiment concluding the investigation.

It should be notice that, to our knowledge, it the first quantification ever done before. The plasticity of rejection rate was therefore investigated as a function of sex-ratio and mate encounter rate. The encounter rate reached maximum value for balanced proportion of male and female and decreased as the sex ratio unbalanced. Higher value of success was nevertheless observed for a pro-male sex-ratio.