Amphipod Symbionts of the Urchin *Echinometra oblonga*

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Abstract

The purpose of this study was to determine the density of amphipods and number of amphipod species found on Oblong Urchins, *Echinometra oblonga*, in Kahuku, Oahu, Hawaii. Amphipods are found to reside symbiotically with many echinoid species, but there is no previous record of amphipod symbionts residing on *Echinometra oblonga*. At Kahuku there was found an average of 4.3 amphipods per urchin. There were significantly more juveniles than adult females and significantly more adult females than adult males. The amphipods maybe commensalistic symbionts.

Keywords: Amphipoda; *Echinometra oblonga*; Urchin; Symbiosis; Hyalidae

Introduction

Amphipods (Arthropoda: Malacostraca) have a worldwide distribution and inhabit a variety of niches spanning benthic, free-swimming, and parasitic habitats (Volbehr and Rachor 1997, Berge et al. 2004). Symbiotic amphipods live on a variety of different host organisms including sponges (Oshel and Steele 1985) and echinoderms of all classes (Vader 1978, Berge et al. 2004). The symbiotic relationships between amphipods and their echinoid hosts are diverse in nature, but have yet to be studied in great detail (Berge et al. 2004). These interactions can be parasitic (Stroobants 1976, Oshel and Steele 1985, Lowry and Stoddart 1989, Berge et al. 2004, Gibbs et al. 2011), mutualistic, or commensalistic (Volbehr and Rachor 1997, Lackschewitz and Reise 1998, Berge et al. 2004). The amphipod species *Lepidepectreella andeep*, *Euonyx chelates* and *Paramphithoe hystrix* feed directly on the tissue of the living host (Oshel and Steele 1985, Berge et al. 2004). Many other amphipods act as scavengers on damaged or dead tissue (Stroobants 1976, Lowry and Stoddart 1989).

Sea urchins of the genus *Echinometra* are distributed throughout the tropical Pacific, Indian Ocean and East Africa to the Red Sea (Hiratsuka and Uehara 2007, Lee and Shin 2012). Many urchins have evolved defenses in order to deal with ectoparasites (Coppard et al. 2012), but some urchins have established symbiotic relationships, including mutualism and commensalism (Oshel and Steele 1985, Sonnenholzner et al. 2011).

According to the comprehensive lists provided by Vader (1978) and Berge et al. (2004), a symbiotic relationship between *Echinometra oblonga* and any amphipod species has not been reported in the literature. However, amphipods (Hyalidae) do occur among the spines of *Echinometra oblonga* (personal observation) (Figure 1). The purpose of this study was to determine the density of amphipods and number of amphipod species found on *Echinometra oblonga* in Kahuku, Oahu, Hawaii.

Materials and Methods

*Echinometra oblonga* specimens were collected from three different locations on the island of Oahu, Hawaii: Kahuku (21.68065° N, 157.941757° W), Hau’ula (21.613265° N, 157.910711° W), and Nanakuli (21.379301° N, 158.146432° W). Sixty urchins were collected at Kahuku. An additional seven urchins were obtained at Hau’ula and two at Nanakuli. Each urchin was placed in an individual re-sealable
bag filled with seawater. To remove the amphipods, the collected *E. oblonga* were submerged briefly (10 seconds) in 70% ethanol and shaken. Amphipods exposed to the ethanol changed color (from black to red) and detached from the urchin. *Echinometra oblonga* were then checked for any amphipods lodged between the spines. All amphipods were counted and classified as: adult male, adult female, and juvenile (Hume et al. 2005). A dichotomous key (Chapman 2007) was used to determine the family. Specimens were also sent to the Gulf Coast Research Laboratory in the College of Science and Technology at the University of Southern Mississippi for species identification. Other urchins (*Tripneustes gratilla* and *Echinothrix calamaris*) of similar coloration were also examined for the presence of amphipods. Student’s T-test was used in order to identify population significance.

**Results**

The amphipod, Hyalidae sp., was only found on *E. oblonga* in Kahuku, and not on the *E. oblonga* collected in Nanakuli and Hau’ula. There were no amphipods on *Echinothrix calamaris* or *Tripneustes gratilla*. Amphipods were not universally present at Kahuku, but were found on 90% of the *E. oblonga* collected.

![Amphipod Ratio](image)

Figure 2: The ratio of adult male, adult female, and juvenile amphipods found on *Echinometra oblonga* in Kahuku, Oahu (21.680650°N, 157.941757°W).

All amphipods collected were of the same species. The average number of amphipods found on each *E. oblonga* at Kahuku was 4.3. Of these, there were an average of 0.47 adult males, 1.4 adult females, and 2.4 juveniles per urchin (Figure 2). There were significantly more adult females than adult males (P=0.0001) and significantly more juveniles than adults (P=0.0387).

**Discussion**

Given the limited number of sites investigated, perhaps Hyalidae sp. is restricted to the Kahuku reef flat, but further sampling is needed to confirm this due to small sample sizes. This may be due to their life history cycle. Amphipods are not broadcast spawners, but instead exhibit internal fertilization (Hume et al. 2005) and provide extended parental care for their offspring (Thiel 1999). Juveniles were observed seeking shelter beneath an adult female [presumed mother] (personal observation). These two traits may serve to limit the ability of the amphipod (Hyalidae sp.) from dispersing to other areas on the island. Other explanations as to why the amphipods were only found in Kahuku could be that they were only recently introduced into the area and have yet to disperse, or that the symbiotic relationship with *E. oblonga* is a recent association.

The relationship between Hyalidae sp. and *E. oblonga* may be commensalistic. The symbiotic amphipods are in the family Hyalidae and most likely from either the genus Hyale or Parhyale (Thomas 2014). Amphipods of these and related genera feed on algae. The amphipods, Hyalidae sp., feed on the algae which are readily available around where the *E. oblonga* inhabit. The urchins provide a refuge from possible predation for the amphipods.

The significantly greater number of adult females than adult males suggests that there may be competition for females resulting in a polygynous reproductive strategy. The greater number of juveniles suggests that the amphipod species may exhibit a life history strategy centered on high reproductive rates.

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Works Cited


