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Cost of courtship-effects of male-male competition on harm experienced by Hyalella amphipods

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Abstract

Recent research has shown that sexual conflict is very common in nature. It arises because of the different evolutionary interests of the sexes. Sexual conflict is by definition costly to organisms and in most cases, is more detrimental to one sex than the other. This occurs because strategies that maximize the fitness of one sex can reduce the fitness of the other sex (1). In many species, males have... Read More

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1. Introduction
Recent research has shown that sexual conflict is very common in nature. It arises because of the different evolutionary interests of the sexes. Sexual conflict is by definition costly to organisms and in most cases, is more detrimental to one sex than the other. This occurs because strategies that maximize the fitness of one sex can reduce the fitness of the other sex (1). In many species, males have a higher optimal mating rate than females. Strategies males use to maximize mating success can decrease female fitness (2, 3). Hence, sexual conflict often takes the form of a behavioral conflict which can have population-level consequences by reducing the mean female fitness in a population, which, in theory, can cause population extinction (1).

We hypothesized that increased encounters between the sexes, due to changes in population density and sex ratio, would result in lower female fitness (survival and fecundity). We also hypothesized that females interacting with males from a different population would incur higher costs than females interacting with males from the same population due to a lack of an evolutionary history with foreign males.

2. Study System
Study species: We used an amphipod species in the OK-L clade in the Hyalella azteca species complex (6).

We collected individuals from two populations: Dripping Spring, Custer County, OK and Bowman Spring, Ellis County, OK.

3. Experimental Design

Experiment 1: Effects of density and sex ratio on female survival
Four different kinds of populations, each consisting of 20 amphipods, were set up. For the first three kinds of populations, the percentage of the two sexes was manipulated so that the sex ratio was varied. The control consisted of a sex ratio typical of populations in nature (60% female and 40% male; 5). The other two populations were male biased (60% male) or female biased (20% male).

We used larger jars to manipulate density. The populations were set up similar to the control used in the sex ratio experiment, however, the jar was ~100% larger thus reducing the density of amphipods (Figure 3). We compared the survival of females in these larger jars to those in the in sex ratio control to test for density effects. For each kind of population, we set up 5 replicates.

Experiment 2: Effects of male identity and sex ratio on female fecundity.
In this experiment, we used a two-by-two factorial design. The male identity treatment consisted of males from Dripping Spring (same population) or Bowman Spring (different population) and this was crossed with a sex ratio treatment with either normal (60:40 female to male) or male biased (40:60 female to male) sex ratios. We counted the number of eggs in the female’s marsupium (ventral brood pouch; Figure 4) as a measure of female fecundity.

4. Results

Figure 5. Survival in male-biased populations was lower compared to female-biased and control populations.

Figure 6. Survival was greater in more dense populations.

Figure 7. Under control (i.e. typical) sex ratios, female fecundity tended to be lower when interacting with males from the same population. In populations with male biased sex ratios, female fecundity was not dependent on male population of origin.

5. Discussion
In experiment 1, we discovered that female survival was lower in populations with male-biased sex ratios. This could have been due to more female-male interactions which led to more male harassment and lower female fitness. Unlike what we predicted, female survival was higher in more dense populations. Collectively, these results show that population parameters can affect sexual conflict.

In the second experiment, females were not better to defend against male PCMG attempts defended in conflicts against males from their own population. It is possible that behaviors employed by females work equally well regardless where males come. These results contrast with studies on insects where the evolutionary labile chemicals used in sperm competition have negative effects on female fitness (e.g., 7).

Our study is one of the few that has examined how sexual conflict affects female fitness. Sexual conflict can lead to the coevolution of reproductive traits. In Hyalella amphipods, the male gnathopod (Figure 8) has been identified as a sexually antagonistic trait; however, we know little about female traits that mediate conflict resolution (4). Populations with greater sexual conflict can diverge more quickly emphasizing a possible role of sexual conflict in the formation of new species (7). Future studies will examine how natural variation in population parameters affect sexual conflict and its consequences in nature.

Literature Cited