REPRODUCTIVE COSTS ARISING FROM INCOMPLETE HABITAT SEGREGATION AMONG THREE SPECIES OF LEUCORRHINIA DRAGONFLIES

by

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(With 3 Figures)
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Introduction

Closely related species that share ecological space may diverge in a manner that reduce the costs of competition (Brown & Wilson, 1956; Fenchel, 1975; Milligan, 1985; Grant, 1986). However, a lack of divergence may be seen under several conditions. First, physiological or environmental constraints may restrict opportunities for divergence (Orians & Wilson, 1964; Gould & Lewontin, 1979; Mayr, 1983). Second, when two species compete for a single limiting resource, character convergence may be an adaptive response (Abrams, 1987). Finally, if range or habitat overlap was a recent phenomenon, divergence may not have had sufficient time to evolve, and the community may not be at equilibrium.

In a community of adult Leucorrhinia dragonflies, males appear to incur significant costs as a result of competitive interactions. These costs may be suffered during interspecific aggression, interspecific mating and interspecific mate-guarding (guarding females against heterospecific intruders). In the case of interspecific aggression, the benefits of species
discrimination (fewer agonistic encounters) may be superseded by tactical costs incurred by the territorial male during assessment (an assessor may be more likely to be dealt the first blow) (Singer, 1989).

Here I describe reproductive costs associated with interspecific mating attempts and interspecific mating-guarding. Interspecific mating may have high energetic costs, risk of injury and elevated rates of predation affecting both males and females. A male that mates with a female may either leave the territory or be unable to defend it during the mating process, which could ultimately result in loss of territory ownership (Sherman, 1983; Waage, 1984). If sperm transfer occurs, males and females may waste gametes on zygotes that will not develop or will have reduced viability.

Males that guard their ovipositing females against heterospecific intruders may also suffer from energy loss, risk of injury and increased predation. As with interspecific mating attempts, any prolonged chase may also cost the guarding male his territory. An additional cost to both males and females is the indirect effect of loss of male vigilance; a male who chases an intruding male leaves his female vulnerable to takeover by subsequent intruders. If the next intruder is conspecific, the chasing male will probably lose part of his reproductive output (Waage, 1979; Fincke, 1984; Siva-Jothy, 1987; Michiels & Dhont, 1988). If the next intruder is heterospecific, the costs to males and females will be those already described for interspecific matings.

In this report, I first describe the pattern of habitat overlap in Leucorrhinia mating territories. Then I assess the costs resulting from this overlap by addressing the following questions:

1. Do males attempt to mate with conspecifics in preference to heterospecifics?
2. If a prezygotic isolating mechanism reduces the probability of interspecific matings, when does it operate?
3. Do mate-guarding males discriminate between conspecific and heterospecific intruders?
4. What are the reproductive consequences of chasing heterospecific intruders?

Methods

Study site and species.

Leucorrhinia frigida, L. proxima and L. intacta are small libellulid dragonflies that occupy broadly overlapping ranges in northern United States and Canada. The study site was a series of marshes and ponds at Cedar Creek Natural History Area in east central Min-