Alternative Mating Tactics in a Tropical Damselfly

by Brenda Larison, Senior Research Fellow,
Center for Tropical Research, Institute of the Environment, UCLA

Damselflies and dragonflies (known collectively as odonates) are well known for their variety of strategies and tactics for finding mates. In some species, males go to a likely spot and sit and wait for females to come along, while in other species males patrol up and down a stream actively searching for females. Sit-and-wait species are often territorial, while patrolling species are involved in more of a scramble competition. Within territorial species there are males that are able to hold territories and thereby attract females, while other males, usually smaller, can only gain matings by sneaking onto the territories of other males. Once mating has taken place, the pair typically travels in tandem, the male guarding the female while she fertilizes and lays her eggs one by one (Figure 1).

For several years now I have traveled to Panama during the dry season to study alternative mating tactics in a species of tropical damselfly (Figure 1). I have conducted these studies at a large number of pools along streams that cross Pipeline Road in Soberania National Park. Pipeline Road is a famous birding destination, but is also great for dragonfly and damselfly watching.

Figure 1. *Left: Male damselflies (red) guard females as they lay eggs in a twig on the water surface. Right: Male damselfly perching and waiting. (Damselfly photos contributed by Micky Andrews.)*

In this species, the tactics echo those strategies found among different species of odonates. Males can either perch in vegetation around a pool and wait for unmated females to fly by or they can hover over the surface and try to disrupt tandem pairs that are laying eggs on leaves and twigs on the water surface. Unlike many species, males are territorial regardless of the tactic they are using. Rather than flying up and down the stream, males using the hovering tactic remain in a particular area and fight with other males for the right to hover there.

I have been looking at the influence of environmental variation on the use and fitness of these two tactics. I have focused on the influence of the physical and social environment, and found the light environment to be an important determinant of how much males use the hovering tactic (more in high light situations) and the mating success of males using that tactic (better in high light situations). I believe reduced predation risk may be part of the reason, but it remains to be tested. The success of the hovering tactic is also highest when there are high densities of tandem pairs. Environmental influences on tactic use and success have often been overlooked in studies of alternative mating tactics. Many more studies examine the influence of male morphology (size/shape), which is usually an important determinant of mating tactic use and success.

Male morphology is also important in this species, but the relationship between morphology and tactic use is complicated by environmental variation. I examined the relationship between wing loading and hovering in the damselflies. Wing loading is simply mass divided by wing area, so the more mass a

certain wing area has to support, the higher the wing loading. As you might imagine, having high wing loading makes flight very expensive (think of the gas mileage a Hummer gets) and low wing loading makes flight inexpensive (more like a Prius). Because of this relationship, I expected to find that males with lower wing loading were the ones more likely to employ the hovering tactic. I found that to be true at some of the sites I studied, but not in others. In some sites, it was the males with high wing loading that hovered most. Why would males for whom hovering was expensive be the ones hovering in some sites?

As I have already noted, certain sites, such as sites with a lot of light and many tandem pairs, are especially good for hovering, while low light sites with few pairs are not so good for hovering (Figure 2). In sites that are good for hovering, there are, understandably, lots of males attempting to hover, and lots of competition for hovering territories. In these sites, where lots of males are trying to hover, and where a male using the hovering tactic has a good chance of finding a mate, it is apparently worth the energy expenditure to hover, even for males with high wing loading. Furthermore, it turns out that males with high wing loading are better competitors.

Figure 2. *Left: A low light sight along Rio Frijolito, Panama. Right: A high light site along Rio Frijolito, Panama.*

In odonates, high wing loading means more flight muscle, faster flight and greater maneuverability. Therefore, in a fight between a male with high wing loading and low wing loading, the high wing loading male is likely to win. This makes males with high wing loading better at holding on to a hovering territory. Males with high wing loading are more likely to hover at highly competitive sites that are good for hovering. The higher their wing loading, the longer they can hold a territory at a site, and the greater number of matings they can obtain. Even in sites that are poor for hovering, some males do hover, but here it is the males with low wing loading that can do so cheaply and stick at it long enough to have success at some point (Figure 3).

This research indicates that the evolution and maintenance of alternative mating tactics in this species is complex, and is influenced not only by variation in male quality but by variation in the physical and social environment.

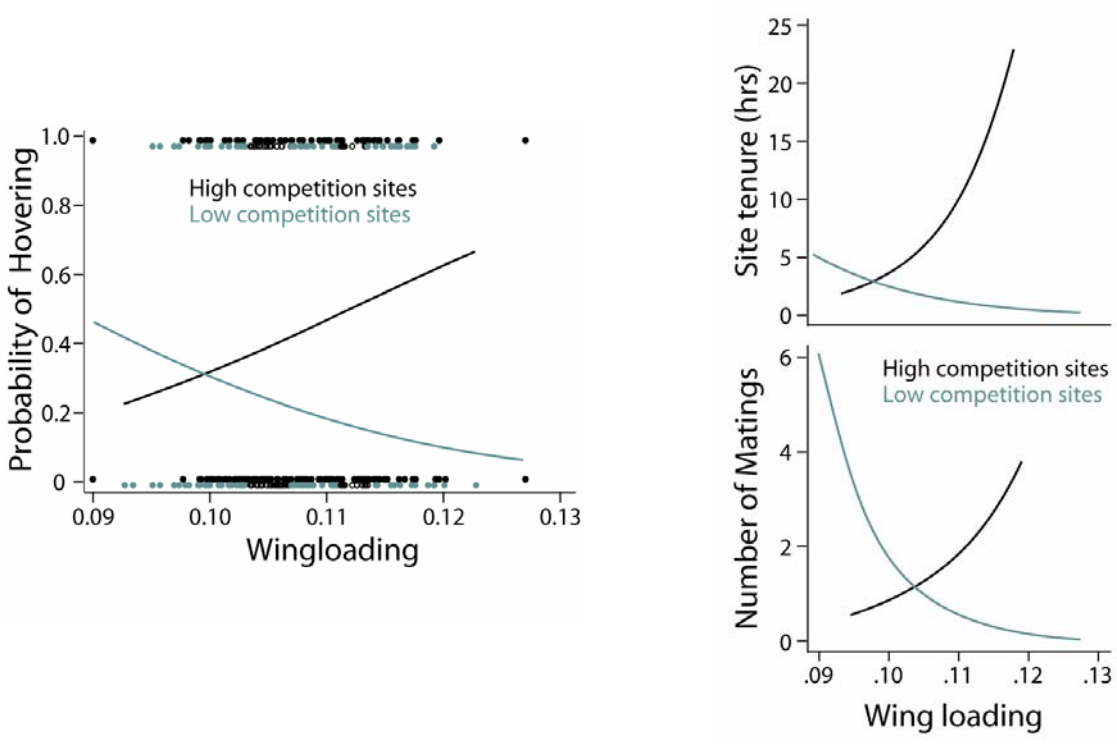

Figure 3. *Left: Probability of hovering is highest for males with low wing loading in low competition sites and highest for males with high wing loading in high competition sites. Right: For males using the hovering tactic, both site tenure (top) and mating success (bottom) are greatest for males with low wing loading in low competition sites and greatest for males with high wing loading in high competition sites.*