

WHEN SEX BECOMES A WRESTLING GAME IN A DRAGONFLY: FEMALE REFUSAL BEHAVIOR TO MALE HARASSERS

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Study Description

In dragonflies, males typically harass females and force copulation, particularly when the female is not guarded by a male. In these species, females usually develop refusal displays and tactics to reduce the impact of coercion on their fitness. Here, we show in a North American large dragonfly, the blue-eyed darner (*Rhionaeschna multicolor*), that females use a series of behavioral displays, which include highjacking the pair on the water surface to break the copulatory wheel and stop male harassment. This highlights the role of the arms race between male–male competition for access to females and coercion avoidance by females to reduce fitness costs.



Photo 1. *Rhionaeschna multicolor* adult. The left panel shows a male perched near the water body. Males spend most of the time on the flight, but they land for short times to rest or eat prey. The right panel shows a female perched near the water body. Females rarely perch near the water as it will expose them to male harassment. They typically perch after they escape harassment. Photo credit: Hayat Mahdjoub.



Photo 2. Hide and seek in the reproductive sites of *Rhionaeschna multicolor*. The left panel shows a male hovering in its territory and searching for females in different corners of the water body. The right panel shows a female laying eggs without a male guarding her (typical for the species), which exposes her to male harassment. This is why females usually prefer to lay eggs in vegetated areas to hide from coercive males. Photo credit: Hayat Mahdjoub.



Photo 3. Male coercion of a female *Rhionaeschna multicolor*. When a female is detected by a male, he attempts to seize her “neck” and fly with her to form the copulatory wheel on air. However, unwilling females usually refuse copulation by grasping the vegetation tightly to avoid flying with the male. Photo credit: Hayat Mahdjoub.



Photo 4. Male attempting to form a copulatory wheel in *Rhionaeschna multicolor*. When a male is successfully attached with the female, he makes a quick 360° turn to fully lock the wheel (male secondary genitalia at the base of the abdomen in the female genital aperture at the tip of the abdomen). Females could resist this attempt by refusing cooperation and sometimes wiggling the head to destabilize male flight and ultimately hijack the pair on the water or vegetation. This lead to the breakup of the pair and the cessation of the coercion. Photo credit: Hayat Mahdjoub.



Photo 5. Copulation of *Rhionaeschna multicolor*. A pair in copula could result from a female consenting or forced to copulate. Photo credit: Hayat Mahdjoub.

These photographs illustrate the article “When sex becomes a wrestling game in a dragonfly: female refusal behavior to male harassers” by Rassim Khelifa published in *Ecology*. <https://doi.org/10.1002/ecy.3435>.