Behavioral Movement of Dragonfly Larvae in the Light Versus the Dark

Emily Brill
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Ronald Hellenthal
Sean Dunlap

Abstract

Dragonfly larva are carnivorous and feed by active hunting, using both visual and tactile senses. Research has shown that movement during the day versus movement during the night may be related to the type of feeding behavior used. Concealment is thought to be caused by adaptation to predators. This experiment consisted of monitoring two different species in the light and the dark and measuring the distance moved during each hour. The significance of the difference in movement varied by species and also by habitat. Therefore, certain species seem to have greater sensitivity to the visual cues of light and dark.

Introduction

Dragonflies typically live two to three years as larvae which means most species spend the majority of their lives in this stage (Corbet, Longfield, and Moore 1960). There seem to be two major obstacles to survival during the larval period: finding prey and avoiding predators. Dragonflies are carnivores and larvae feed on almost any live animal that they detect and that is of appropriate size. They will even eat other Odonata including individuals of the same species. The characteristic feeding habits of dragonfly larvae include a sit and wait method and active hunting. Larvae tend to remain immobile until it detects a moving organism (Corbet 1962). It then orientates itself toward the prey, rapidly extends the labium, and grasps it's prey. The actual method of detecting the prey varies by species and age, but usually includes a combination of both visual and tactile cues. Research shows that it is common for antenna receptors to dominate in the early instars and for sight to become more important as the larvae age (Corbet 1962).

The type of feeding behavior used often coincides with the movement seen during the day versus during the night. During the daytime, certain larvae move with quick propulsion from one spot to another or even remain immobile. During the night, they walk slowly over the bottom. It is likely that this is a feeding behavior in which the antennae act as receptors (Corbet 1962). If possible, dragonfly larvae keep themselves concealed. They will hide in the mud, leaves, plants, or other areas of concealment. Research shows that this concealment is to avoid being seen by predators rather than by prey. The majority of the animals they feed on can not recognize them visually. While they are not the only predators of dragonflies, fish seem to be the most important one. It is likely that fish are responsible for the evolution of their defensive behavior (Corbet 1962).

Materials and Methods

This experiment was conducted at the University of Notre Dame Environmental Research Center. It encompasses almost 8000 acres on both sides of the state line between Wisconsin and the Upper Peninsula of Michigan. The property includes many diverse habitats including thirty lakes and bogs. The larva were collected from three of these.

Two species of dragonfly larvae were used for the experiment. Ten Cordulia shurtleffi were collected from Bay Lake. Ten Ladona julia were collected from Bog Pot, a fishless environment and ten were collected from Morris Lake, an environment with fish. Five dragonflies of one of the three groups were used at a time. Approximately twenty-four hours before the experiment was to begin, the dragonflies were fed scuds and other small aquatic insects to control for movement due to hunger. Most of the scuds and other insects were found in Tenderfoot Lake or Morris Lake. Five plastic tubs were lined with small gravel sifted from the

sand pile by the storage shed. The gravel was about a centimeter deep. The tubs were then filled with water from the faucet outside of the wet lab to a depth of about five centimeters. Plexiglass covers were made for each of the tubs with small pieces glued perpendicular to the bottom so it fit snugly on the top of the tub and would not move. A grid was drawn on each cover making 2 cm^2 blocks. The blocks were labeled from A to M along the ends and from 1 to 19 along the sides of the tubs.

Each larva was placed in one plastic tub two hours before the experiment began to allow them to acclimate to their surroundings. The position of the larvae was recorded each hour for five hours in continuous light and then for five hours in continuous dark. During the five hours of continuous dark, a red light was used to see the position of the larvae. A flashlight with red plastic wrap covering the light was only used when the red light was not sufficient to see the larvae in the tub.

After the data was collected, the movements of the larvae were converted from grid numbers to centimeters. The average distance moved for each individual was calculated. Next, the average for each group of larvae was used to compare the amount of movement in the light versus the dark.

Results

Cordulia shurtleffi show a significant difference in behavior between the light versus dark environments (df=9, t=-3.533, p=.006). They showed more movement in the dark versus the light. The *Ladona julia* from the fishless environment also show a significant difference with more movement in the dark than the light (df=9, t=-2.596, p=.029). The *Ladona julia* from the fish environment, however, showed more movement in the dark than the light, but do not show a

large enough difference to reject the possibility that it was due to chance (df=9, t=1.213, p=.256).

Discussion

The results of the analysis show variation of movement by species. The difference between light and dark behavior may be due to varying sensitivity in some species. Adaptation to their environment may also be responsible. *Cordulia* larvae show significantly more movement in the dark than in the light which implies that their visual perception may be very sensitive. On average, L*adona* show less awareness of the light differences.

As previously mentioned, research shows that the absence or presence of predators may also affect the light and dark movement of larvae. The same species, *Ladona*, was used from both fish and fishless lakes to test this difference. It was expected that the larvae from the lake with fish would have adapted to its predator by moving less when it is light. Remaining concealed when there is a threat of predation should increase their survival and make them more likely to move when it is dark. However, this variation within the species was not seen. The *ladona* from the lake without fish showed more movement during the dark than the light, but the *ladona* from the lake with fish did not show a significant difference in movement and actually showed a little more movement during the light than the dark.

The fishless *ladona* may have moved less in the light even though they do not normally have fish to worry about because of genetics and inherited defense mechanisms. It may also be that there are visual predators other than fish from which they must remain concealed. The increased movement of the fish *ladona* during the light could be the result of a search for a place to hide. Also, maybe they were able to tell that there were no predators present in the tubs.

They results for the fish *ladona*, however, were not even found to be significant.

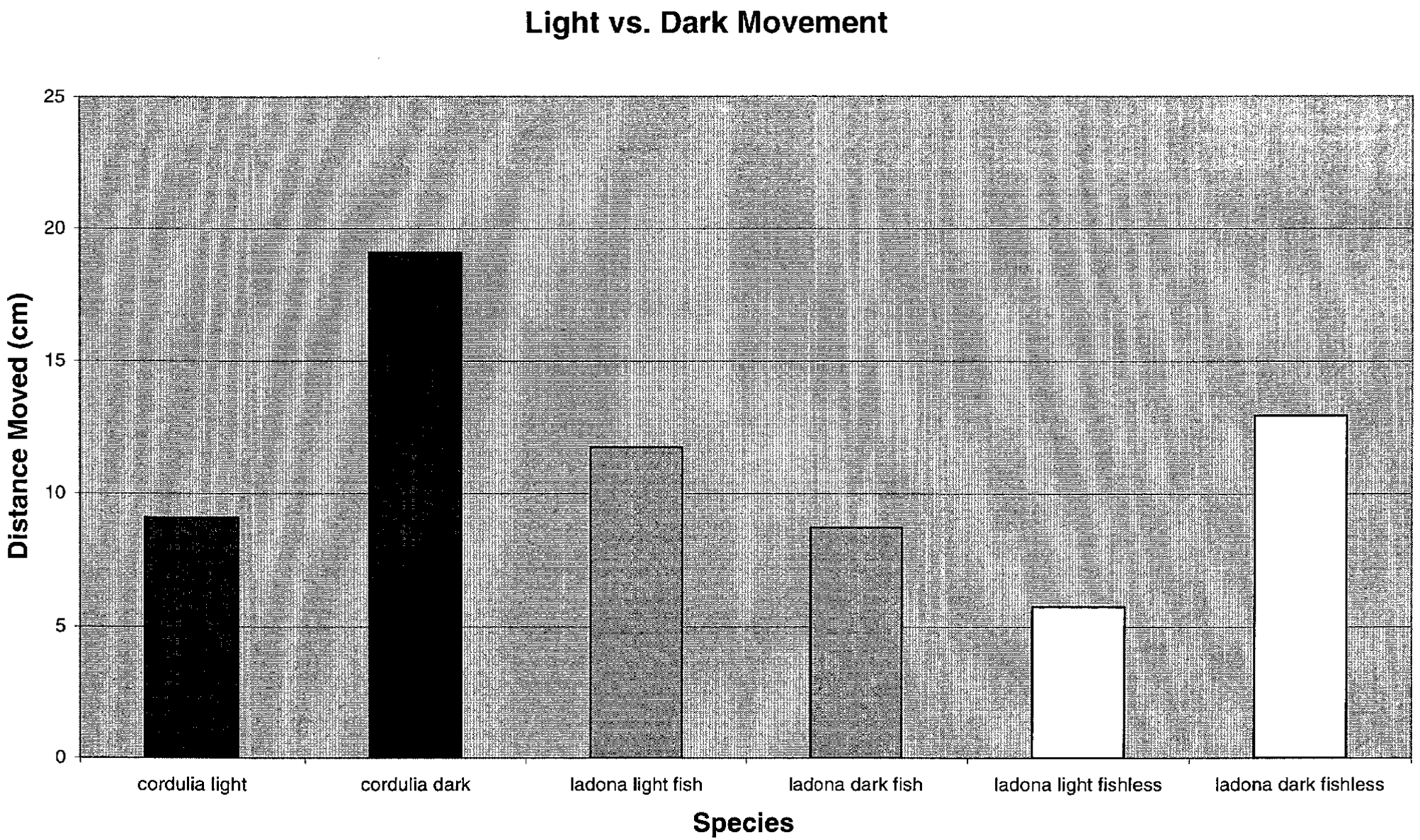
Therefore, the accuracy of this experiment should be tested by running it again and by checking for some of the variable mentioned above.

Literature Cited

Corbet, P.S. 1962. A Biology of Dragonflies. Great Britain: Northumberland Press Limited.

Corbet, P.S., Longfeld, C., Moore, N.W. 1960. Dragonflies. Great Britain: Willmer Brothers and Haram Limited.

	df	t-test	p value
cordulia	9	-3.533	0.006
lodona,fish	9	1.213	0.256
lodona,fishless	9	-2.596	0.029


Light vs. Dark Movement
Distance Moved (cm)
25
20
15
10
5
0
cordulia light
cordulia dark
ladona light fish
ladona dark fish
ladona light fishless
ladona dark fishless
Species