Night Lights

The winking bioluminescence of fireflies signals summer romance. In the eastern two-thirds of North America, summer nights are lit by the flashes of firefly courtship. Each of the hundreds of firefly species has its own characteristic light display; males in flight present their appeals, and females blink their come-hither responses from the bushes or the ground.

Most fireflies spend their entire adulthood, a brief few weeks, seeking mates. With a few exceptions, the adults do not even eat. (Females of predatory firefly species in the genus *Photuris* mimic the response flashes of another species to lure those males to them. When a duped male gets within range, the female mimic captures and eats him.) As all their energy is devoted to courtship and mating, fireflies, which are actually lampyrid beetles, have evolved an elaborate system of precise semaphores.

A study examining the responsiveness of female fireflies of the species *Photinus ignitus* to various aspects of male flashes was published recently by Christopher Cratsley, a graduate student at the time of the study, and Sara Lewis, Cratsley's advisor at Tufts University *(Behavioral Ecology,* January 2003). They also measured the reliability of male flash characteristics as predictors of spermatophore mass. Spermatophores, containing sperm and nutrients, are the "nuptial gift" males present to females.

Field-collected *P. ignitus* males were measured to determine their flash duration, lantern size, body mass, and spermatophore mass. The duration of male flashes, the researchers found, ranges from 56 to 123 milliseconds (ms), with 90 percent of males producing flashes between 56 and 89 ms. Cratsley and Lewis also determined that, early in the mating season, males with longer flash durations and larger body mass produce larger spermatophores. By contrast, lantern size was not correlated with spermatophore mass.

To determine what flash qualities attracted females, the researchers used artificial lights to simulate duration, lantern size, and distance of male flashes. They found that the interest of female *P. ignitus,* as indicated by a responding flash, increases with the duration of male flashes, but that interest wanes when the duration is extended to 132 ms, beyond the natural range for the species. The condition of the females is also an important factor: females that have mated or been fed are not as responsive to longer male flashes.

Cratsley and Lewis have shown that, early in the season, females preferentially select males that signal their ability to produce large spermatophores with longer flashes. The light show on summer nights, though still dazzling, is a bit less mysterious.

Iridescent Butterflies

Deep-forest species of *Heliconius* butterflies use polarized light to attract mates, report Alison Sweeney and Sönke Johnsen, of Duke University, and Christopher Jiggins, of the University of Edinburgh, Scotland, in the 1 May issue of *Nature.* Their study, conducted at the Smithsonian Tropical Research Institute in Panama, elucidates an important new type of mate recognition in this highly visual group.

Polarized light is light whose electric field oscillates in a direction perpendicular to the direction the light is traveling. Bees use polarized light, to which the dorsal, or skyward, part of their compound eyes is sensitive, to navigate. Several species of butterflies, too, have been known to have highly sophisticated compound eyes that can detect the angle at which polarized light oscillates. Now there is a clear indication of what one species of butterfly does with this ability.

Sweeney and colleagues monitored the response of male butterflies to female wings mounted behind various optical filters and moved to simulate flight. Depolarizing filters prevented transmission of polarized light but allowed visible and ultraviolet light to pass through, permitting the color patterns of wings to be seen. Control filters were made of a similar material but were polarization neutral.

Two closely related species of *Heliconius* were tested. Iridescent *Heliconius cydno* wings have scales that polarize reflected light. Males of this species approached conspecific female models in the polarization-neutral treatment significantly more often than models in the depolarized treatment, which had lost their polarized luster. Noniridescent *Heliconius melpomene malleti* butterflies, which do not reflect polarized light, were tested under similar conditions with conspecific females. The *H. melpomene malleti* males approached both treatments with equal frequency.

It is likely these recently diverged species, which overlap in range, may be using light in different ways to distinguish their courtship displays. The flashes of blue iridescence are a signal to scientists, too, to consider butterfly mating behavior in a new light.

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