Science & Ecology

Nature's Night Lights

By Edna Greig

Fireflies, or lightning bugs, have fascinated humans through the ages with their evening displays of twinkling lights. Fireflies actually are beetles, not flies, and belong to the family Lampyridae ("shining ones"). Like all beetles, they have hardened outer wings, called elytra, which protect the membranous inner flight wings. There are about 2,000 species of fireflies worldwide. About 200 species occur in the United States, mostly in the eastern half of the country.

Firefly light, or bioluminescence, results from a chemical reaction and emanates from an organ called a lantern in the beetle's abdomen. Both males and females have lanterns, although male lanterns are larger. Other bioluminescent organisms exist, but fireflies are the only ones that flash their lights.

During their two-week adult life, male fireflies fly about and flash to attract females. Each species has a unique flash. Females watch the show from a perch on or near the ground. If a female is impressed by a certain male, she will emit a brief "come hither" flash that also is unique to her species. A flash dialogue will continue between the male and female until they find each other and mate. Firefly mating is hypercompetitive, as males greatly outnumber females. A female will respond to the brightest or most impressive male flash as he is likely to make the fittest parent.

Fireflies are fun to watch on warm evenings and are best observed when the air is still and when there is little moonlight or artificial light. With practice, you can distinguish different species based upon the color and pattern of their flashes, their flight patterns, their habitat, and the time of day and year that the adults are active.

For example, *Photinus pyralis*, the common eastern firefly, is the ubiquitous small firefly of meadows and fields. It first appears around late June and becomes active at dusk. Males fly low over the grass and emit a long yellow flash that traces an ascending "J" pattern.

Photuris pennsylvanica, the woods firefly, is larger than the eastern firefly and prefers damp wooded areas. It usually appears in early to mid June, but doesn't become active until well after dark. The male flies high and fast and emits brief green flashes. A receptive female will flash a response to a potential mate of her species. But *Photuris* females also are tricksters and can mimic the female response flashes of several different species of the smaller *Photinus* firefly and lure an unsuspecting male *Photinus* to her grasp. The female *Photuris* then devours the male *Photinus* to obtain a protective toxin that he has but she lacks. By eating him and his toxin, she and her eggs become unpalatable to predators.

Shortly after mating, females lay their eggs on moist ground. The eggs hatch into larvae after about three or four weeks. The carnivorous larvae, also called glow worms because they too are bioluminescent, feed on snails, slugs, and other invertebrates for the next year or two. They then pupate for a short period underground and emerge as adult fireflies.

The chemicals luciferin and luciferase play key roles in firefly bioluminescence. Because of their unique properties, they also are widely used in biomedical research. In the past, these chemicals were obtained from fireflies collected in the wild, and scientists believe that this collecting adversely affected firefly populations. Today, the chemicals can be produced synthetically, which may help firefly populations to rebound.

To learn more about fireflies and to volunteer for a citizen science monitoring project, visit Boston's Museum of Science Firefly Watch website at www.mos.org/fireflywatch.

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