



# BUG BIZ

Pest Management and Insect Identification Series



## *Photinus pyralis*, Big Dipper Firefly (Coleoptera: Lampyridae)

Able Chow, Forest Huval, Chris Carlton and Gene Reagan



Adult big dipper firefly in natural habitat. Lloyd, 2018, used with permission.

### Description

Adult big dipper fireflies are small, elongated beetles three-eighths to three-fifths of an inch (9 to 15mm) in length, soft in texture and densely covered by small hairs. They have large eyes, black wing covers (elytra) with yellow margins and large pronota (top surface of thorax) extending over their heads. The color pattern on the pronotum is variable, but the center is always pink with a black center dot. The light-producing organs differ between sexes. Males possess these organs on two segments, females on one.

Distinguishing adult big dipper fireflies from other species based on external appearance in the same genus, *Photinus*, is complicated by color and size variations within populations. Dissection is required for confident species identifications. However, in the wild, male big dipper fireflies can be easily identified through the species-specific flash



A big dipper firefly larva in natural habitat. Lloyd, 2018, used with permission.

pattern and flight path, which forms a distinct J-shaped courtship flash. This flash is also the basis of the common name.

Big dipper firefly larvae are small, six-legged, elongated insects with distinct body segments, each armed with a flat dorsal plate. They have small heads, short antennae and two light-producing organs on the abdomen. Species identification of larvae requires rearing them to adults. The pupae of *Photinus* resemble a pale white version of the adult with the wings folded onto the sides of their bodies.

### Life Cycle

Fireflies undergo complete metamorphosis, with a life cycle consisting of four developmental stages: egg, larva, pupa and adult. *Photinus* females lay small, round eggs about one-thirtieth of an inch (0.8 mm) in diameter in moist crevices. The eggs glow slightly when first laid, but this fades over time before hatching within 18 to 25 days. Larvae are nocturnal, solitary predators inhabiting a variety of moist habitats. They feed on soft-bodied invertebrates, such as snails and worms. *Photinus* larvae spend much of their time concealed in organic matter or underground and construct cells from organic matter in which to molt or pupate. Larval *Photinus* can be found throughout the year, and the larval stage may require one to two years to complete. Like most fireflies, *Photinus* pupae glow, and the light intensifies when disturbed. Pupa require nine to 15 days to mature depending on temperature. As adult emergence (eclosion) approaches, the luminescence of the *Photinus* pupae fades, and the body takes on the color of the adult.

Adult big dipper fireflies have reduced mouthparts and do not feed, relying on fat reserves stored during the larval stage to sustain all their adult activities. Throughout summer, male and female big dipper fireflies engage in a flash pattern courtship display that is specific to each species. The initiation of flashing is dependent on the light environment. In dark woodlands, males may begin flashing as early as 20 minutes before sunset. In open fields, they can begin flashing as late as 11 minutes after sunset, continuing for about 90 minutes. Male fireflies fly in U-shaped arcs, flashing at

Visit our website: [www.lsuagcenter.com](http://www.lsuagcenter.com)

intervals that produce the J-shaped light path. Female big dipper fireflies identify males through their flash patterns while remaining stationary on low vegetation. They signal to a preferred mate using a single flash. Flash patterns vary among males, and females seem to prefer those with the longest duration flashes.

## Ecology and Management

The big dipper firefly is the most common firefly species in the eastern U.S., occurring in large numbers in moist habitats. The range of big dipper fireflies extends from southern Texas all the way to southern New York and west to Kansas and Nebraska with isolated records further west. Larvae require wet meadows and woodlands or areas along margins of lakes and streams for development.

All fireflies store toxic chemicals called lucibufagins that render them unpalatable to predators, and they advertise this chemical defense to potential predators in the form of bioluminescence in all four life stages. The chemical defense provided by lucibufagins and bioluminescent warnings does not protect big dipper fireflies from specialized predators and parasitoids. Female fireflies belonging to the genus *Photuris* and known as “femme fatale fireflies” specialize in luring and devouring male big dipper fireflies and those of other species, acquiring both nutrition and lucibufagins from its victim. Phorid fly species in the genus *Apocephalus* are known parasitoids of *Photinus* adults, including big dipper fireflies.

Artificial outdoor lighting severely disrupts courtship communication of fireflies, preventing successful



Male big dipper firefly. Louisiana State Arthropod Museum specimens, Able Chow.

reproduction. Bright, broad spectrum outdoor lighting virtually eliminates fireflies from an area. Low intensity lighting in the red end of the spectrum is less disruptive. Fireflies are only one of many animal species that are adversely impacted by light pollution. Large scale community action is often required to mitigate light pollution impacts and restore suitable breeding habitats for fireflies.

## References

- Buschman, L. L. 1977. Biology and bioluminescence of selected fireflies in three genera: *Pyraoctomena*, *Photinus*, and *Photuris* (Coleoptera: Lampyridae). 182 pp. Ph.D. Dissertation, University of Florida, Gainesville, FL. 182 pp.
- Blum, M. S., and A. Sannasi, A. 1974. Reflex bleeding in the lampyrid *Photinus pyralis*: defensive function. *Journal of Insect Physiology* 20: 451-460.
- Branham, M.A., and J.W.Wenzel. 2003. The Origin of Photic Behavior and the Evolution of Sexual Communication in Fireflies (Coleoptera: Elateroidea). *Cladistics* 19: 1-22.
- Cratsley, C. K. 2004. Flash Signals, Nuptial Gifts and Female Preference in *Photinus* Fireflies. *Integrative and Comparative Biology* 44: 238-241.
- Lloyd, J. E. 1966. Studies on the flash communication system in *Photinus* fireflies. Miscellaneous Publications no. 130, Museum of Zoology, University of Michigan. Pp. 1-95.
- J. E. Lloyd 1973. Firefly Parasites and Predators. *Coleopterists Bulletin* 27: 91-106.
- Lloyd, J. E. 2018. A naturalist's long walk among shadows: of North American *Photuris* – patterns, outlines, silhouettes... echoes. Self-published, Gainesville, FL, USA. 477 pp.
- Owens, A., and S. Lewis. 2018. The Impact of Artificial Light at Night on Nocturnal Insects: A review and Synthesis. *Ecology and Evolution* 8: 11337-11358.
- Lewis, Sara & Cratsley, Christopher & Demary, Kristian. (2004). Mate recognition and choice in *Photinus* fireflies. *Ann. Zool. Fennici*. 41. 809-821.
- Underwood, T., D. Tallamy, and J. Pesek. 1997. Bioluminescence in Firefly Larvae: A Test of the Aposematic Display Hypothesis (Coleoptera: Lampyridae). *Journal of Insect Behavior* 10: 365-370.

---

### Authors:

Able Chow, Forest Huval, Chris Carlton and Gene Reagan

William B. Richardson, LSU Vice President for Agriculture  
Louisiana State University Agricultural Center  
Louisiana Agricultural Experiment Station  
Louisiana Cooperative Extension Service  
LSU College of Agriculture

Pub. 3717 (500) 4/20

The LSU AgCenter and LSU provide equal opportunities in programs and employment.

Visit our website: [www.lsuagcenter.com](http://www.lsuagcenter.com)