

# Public Health

Department of Entomology

## BLACK FLIES: BIOLOGY AND PUBLIC HEALTH RISK

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Black flies, known also as “buffalo gnats” and “turkey gnats,” are very small, robust flies that are annoying biting pests of wildlife, livestock, poultry, and humans. Their blood-sucking habits also raise concerns about possible transmission of disease agents. You are encouraged to learn more about the biology of black flies so that you can be better informed about avoiding being bitten and about their public health risk.

### Are Black Flies a Public Health Risk?

Black flies can be annoying biting pests, but none are known to transmit disease agents to humans in the U. S. However, they transmit one parasitic nematode worm that infects humans in other regions of the world. *Onchocerca volvulus* causes a significant human disease known as “onchocerciasis” or “river blindness” in equatorial Africa and mountainous regions of northern South America and Central America.

The bites of black flies cause different reactions in humans, ranging from a small puncture wound where the original blood meal was taken to a swelling that can be the size of a golf ball. Reactions to black fly bites that collectively are known as “black fly fever” include headache, nausea, fever, and swollen lymph nodes in the neck.

In eastern North America, only about six black fly species are known to feed on humans. Several other species are attracted to humans, but they typically do not bite. However, the non-biting species fly around the head and may crawl into the ears, eyes, nose, or mouth, causing extreme annoyance to anyone engaged in outdoor activities.

Black flies can be found throughout most of the U. S., but their impact on outdoor activities varies depending on the specific region and time of year. For example, in parts of the upper Midwest and the Northeast, black fly biting can be so extreme, especially in late spring into early summer, that it may disrupt or prevent outdoor activities such as hiking, fishing, and kayaking.

Besides being a nuisance to humans, black flies can pose a threat to livestock. They are capable of transmitting a number of different disease agents to livestock, including protozoa and nematode worms, none of which cause disease in humans. In addition to being vectors of disease agents, black flies pose other threats to livestock. For example, when numerous

enough, black flies have caused suffocation by crawling into the nose and throat of pastured animals. On rare occasions, black flies have been known to cause exsanguination (death due to blood loss) from extreme rates of biting. Saliva injected by biting black flies can cause a condition known as “toxic shock” in livestock and poultry, which may result in death.

### How Many Types of Black Flies Are There?

Black flies are true flies (Order Diptera) in the family Simuliidae, which includes more than 1,700 species worldwide. In North America, 255 species in 11 genera have been identified, but additional species remain to be discovered and named. Very little is known about black flies in Indiana, and there are no estimates of the number of species in the state. For perspective, 12 species have been documented in Illinois, while over 30 species have been documented in both Minnesota and Wisconsin, where black fly habitats are more abundant.

### How Can I Recognize an Adult Black Fly?

Black flies range in size from 5 to 15 mm, and they are relatively robust, with an arched thoracic region (Figure 1). They have large compound eyes, short antennae, and a pair of large, fan-shaped wings. Most species have a black body, but yellow and even orange species exist.



Female black fly taking a blood meal  
 (Photo credit: Oklahoma State University)

### What Is the Life Cycle of Black Flies?

Black flies undergo a type of development known as “complete metamorphosis” (Figure 2). This means the last larval stage molts into a non-feeding pupal stage that eventually transforms into a winged adult. After taking a blood meal, females develop a single batch of 200-500 eggs. Most species lay their eggs in or on flowing water, but some attach them to wet surfaces such as blades of aquatic grasses.

The length of time it takes an egg to hatch varies greatly from species to species. Eggs of most species hatch in 4-30 days, but those of certain species may not hatch for a period of several months or longer. The number of larval stages ranges from 4-9, with 7 being the usual number. The duration of larval development ranges from 1-6 months, depending in part on water temperature and food supply. The life cycle stage that passes through winter is the last stage larva attached underwater to rocks, driftwood, and concrete surfaces such as dams and sides of man-made channels.

The pupal stage is formed the following spring or summer, typically in the same site as the last stage larva, but may occur downstream following larval “drift” with the current. Adults emerge from the pupal stage in 4-7 days and can live for a few weeks. Adults of most species are active from mid-May to July. The number of generations completed in one year varies among species, with some having only one generation, but most species that are major pests complete several generations per year.

Black fly larvae and pupae develop in flowing water, typically non-polluted water with a high level of dissolved oxygen.

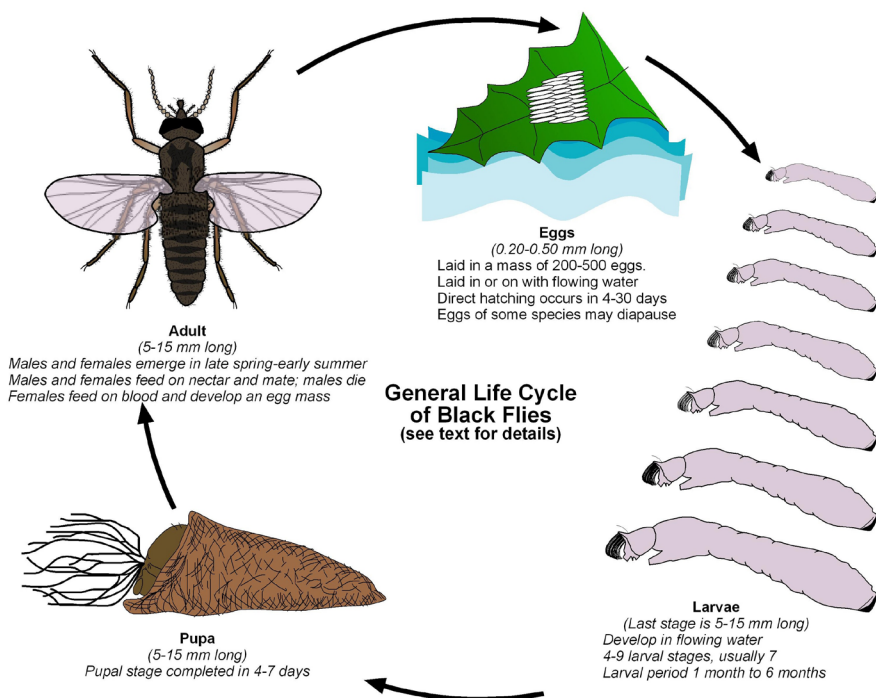
Suitable aquatic habitats for black fly larval development vary greatly and include large rivers, icy mountain streams, trickling creeks, and waterfalls. Larvae of most species typically are found in only one of these habitats.

Larvae remain attached to stationary objects in flowing water, held on by silken threads extruded from glands located at the end of the bulbous abdomen. Depending on species, mature larvae range from 5-15 mm in length and may be brown, green, gray, or nearly black in color. They possess a large head that bears two prominent structures known as “labral fans” that project forward (see Figure 2). Labral fans are the primary feeding structures, filtering organic matter or small invertebrates out of the water current.

Pupae remain attached to stationary objects in flowing water as well. They typically are orange and appear mummy-like because the developing wings and legs are tightly attached to the body. Pupae of many species produce a delicate, silken “cocoon” of varying density, weave, and size that partially or nearly entirely encloses them; other species produce hardly any cocoon at all.

### What Should I Know About the Feeding Habits of Adult Black Flies?

It is estimated that females of 90% of the black fly species require a blood meal for the development of eggs. Those of most species feed on mammals, while others feed on birds. Females of some black fly species feed on only one host, whereas others are known to feed on over 30 different host species. No North American species feed exclusively on



General life cycle of black flies. (Illustration by: Scott Charlesworth, Purdue University, based in part on Peterson, B.V., IN: *Manual of Nearctic Diptera*, Vol.1)

humans. Male black flies are not attracted to humans, and their mouthparts are not capable of biting.

Females of most species of black flies feed during the day, usually biting on the upper body and head. Unlike certain species of mosquitoes and biting midges, black flies do not enter human structures to seek blood meals.

### Do Humans Contribute to Black Fly Problems?

Human activities can lead to an increase in black fly numbers in an area. Structures such as concrete dams and concrete-lined stream channels provide excellent developmental sites for larvae and pupae of certain black fly species. In addition, the restoration of polluted streams, especially in New England, has increased the dissolved oxygen content of streams and created suitable larval habitat for some of our most important pest species.

### What Should I Know About Controlling Black Flies?

Control of black flies is difficult, typically aimed at the larval stages, and usually involves aerial applications of insecticides or physically altering the habitat of pest species. The most effective control programs are conducted by state agencies or by professional pest control companies contracted by the state. Any effect is limited in duration, however, in large part because females of pest species are capable of flying long distances from the larval developmental site, and they soon re-infest treated areas.

There is little that an affected homeowner or person engaging in outdoor activities can do to control black flies. For personal protection, it is best to avoid peak periods of black fly activity. In certain states, information pertaining to the predicted “black fly season” in a particular area often can be obtained by contacting a local Cooperative Extension office. When venturing outdoors in infested areas, apply an insect repellent containing DEET, wear protective clothing, and minimize openings such as buttonholes through which black flies crawl in an attempt to feed. Outdoor activities in heavily infested areas may require the wearing of fine-mesh head nets, similar to those worn by beekeepers.

### Where Can I Find More Information on Black Flies?

A recent (2002) textbook by G. Mullen and L. Durden, *Medical and Veterinary Entomology*, has an excellent chapter devoted to black flies that covers biology, behavior, medical and veterinary risk, and information on personal protection and approaches to black fly control.

The following Web sites contain detailed information on black flies:

<<http://www.ento.okstate.edu/ddd/insects/blackflies.htm>>

<<http://ohioline.osu.edu/hyg-fact/2000/2167.html>>

<<http://www.blackfly.org.uk/>>

READ AND FOLLOW ALL LABEL INSTRUCTIONS. THIS INCLUDES DIRECTIONS FOR USE, PRECAUTIONARY STATEMENTS (HAZARDS TO HUMANS, DOMESTIC ANIMALS, AND ENDANGERED SPECIES), ENVIRONMENTAL HAZARDS, RATES OF APPLICATION, NUMBER OF APPLICATIONS, REENTRY INTERVALS, HARVEST RESTRICTIONS, STORAGE AND DISPOSAL, AND ANY SPECIFIC WARNINGS AND/OR PRECAUTIONS FOR SAFE HANDLING OF THE PESTICIDE.

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