When Gnats Attack: Black Flies in Pennsylvania

Black Fly Biology and Life History

Adult black flies (Diptera: Simuliidae) are a severe worldwide pest of humans and animals. Female adults, commonly known as gnats, swarm around the head and body of selected hosts in order to obtain blood required for egg production. Through blood feeding, black flies can be important vectors of diseases.

Fortunately, most Pennsylvania black fly species do not feed on human blood and, therefore, do not transmit parasites, pathogens, and diseases to people. However, some species of black flies do cause serious annoyance and discomfort by their persistent biting, swarming, and crawling behavior. This can result in significant economic losses for areas that depend on recreation and tourism. These small (2-5 mm in length) dark flies reduce our enjoyment of outdoor activities and deter our desire to visit areas with annoying adults. Adult females enter the eyes, ears, nose, and mouth of humans and animals as they locate hosts in their search for blood. Severe allergic reactions to black fly bites are known to occur in some cases. Large black fly populations have been shown to cause enormous agricultural losses through livestock mortality and by decreasing milk, beef, and egg production in livestock and poultry industries.

Typical Black Fly Life Cycle Diagram including egg, larval, pupal, and adult stages

Fifty-three (53) black fly species in 7 genera have been found in Pennsylvania. The aquatic stages are often abundant and important organisms in river ecosystems, where the larvae filter and eat fine food particles from the water column. Black flies play an important role in aquatic and terrestrial food chains where they are preyed upon by many insect predators, fish, amphibians and birds.

The immature stages of black flies are aquatic and exclusively inhabit flowing streams and rivers. They can be found in almost every stream in Pennsylvania, from our tiny, cold spring flows to our very large, warm rivers. Only streams that are severely impaired by acid mine drainage or pollution will not support black fly populations. However, black flies are not found in lakes, ponds, swamps, and other standing water habitats. Stream flow is essential for transporting food and oxygen to the immature stages.
The life cycle includes four stages: egg, larva, pupa, and adult. All are aquatic except the adults, which leave the water to search for food and mates. Black fly species have three general life history strategies. One group of species produces 1 generation per year (univoltine) that matures in late winter or early spring. A second group is also univoltine, but these species develop during late spring or summer. The third and final group of species produces 2 or more generations per year (bivoltine or multivoltine) that typically develop from early summer through fall. Adult females deposit from 150 to 500 eggs in flowing water. Eggs hatch in 2 days to 8 months, depending on black fly species and water temperature. Most species overwinter in the egg stage. Larvae anchor themselves to clean vegetation, rocks, or debris by spinning a small silken pad with their mouthparts and inserting a row of hooks at the end of their enlarged abdomen into the silk pad. This technique allows the larvae to secure themselves in areas of very fast water velocity and orient their body with the abdomen pointed upstream, and head positioned downstream to feed. The larvae filter or scrape very fine organic matter, filamentous algae, bacteria and tiny aquatic animals from the current or substrates. Larval growth is very temperature dependent, with relatively slow growth during the cold winter months and very rapid growth during warm summer water temperatures. Some summer-developing, multivoltine species are capable of completing their entire life cycle in just a few weeks. Pupae secure themselves inside their cocoons with rows of spine-like hooks on their abdomen. Freshly emerged adults fly to streamside vegetation where their wings and bodies quickly dry and harden. Mature adults immediately seek food sources and mates. Both sexes feed on nectar, sap, or honeydew to obtain the sugar used for flight and energy. Only females feed on blood.

In Pennsylvania, 4 closely related black fly species in the Simulium jenningsi complex are responsible for most of the human pest problems during the summer recreational season. The immature stages of this group prefer large, clean, warm streams and rivers. Unfortunately, these species can produce many generations of annoying adults during a single season. The Pennsylvania Black Fly Suppression Program focuses control efforts on these 4 pest species from April to September each year, to reduce black fly populations in the Commonwealth to acceptable levels.

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