

# Public Health

Department of Entomology

## HORSE AND DEER FLIES: BIOLOGY AND PUBLIC HEALTH RISK

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Horse and deer flies are annoying biting pests of wildlife, livestock, 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 horse and deer flies to avoid being bitten and to understand the public health risk posed by these insects.

### Are Horse and Deer Flies Public Health Risks?

The bites of female horse and deer flies are painful and, if numerous enough, can disrupt recreational activities and even the harvesting of some agricultural crops. Their mouthparts include two pairs of cutting “blades” that lacerate skin and cause flow of blood out of the wound, which females lap up with a sponge-like mouthpart. Males have similar, but much weaker mouthparts. They are not capable of biting and do not feed on blood.

The blood sucking behavior of females together with their possible role in the transmission of disease agents have been studied extensively. Numerous viruses, bacteria, and protozoa have been isolated from the bloody, sponge-like mouthpart of females and from their digestive system, but there are no studies showing conclusively that they are capable of transmitting disease agents to humans, with one exception. There is evidence that a deer fly in the western U.S. is involved in the transmission of a bacterium that causes the disease “tularemia,” which also is known as “deer fly fever”

and “rabbit fever.” The role of deer flies in transmission is minor, however, compared to transmission by ticks and via contact with infected small game animals, especially rabbits.

### How Many Types of Horse and Deer Flies Are There?

Horse and deer flies are “true” flies in the insect Order Diptera, and comprise the Family Tabanidae known as “tabanid flies” or “tabanids.” There are an estimated 4, 300 species of horse and deer flies in the world, approximately 335 of which occur in the continental U. S. Of these, over 160 species are horse flies, and over 110 species are deer flies. It is estimated that at least 45 species of horse flies and 30 species of deer flies occur in Indiana. The vast majority of horse flies are in two genera, *Tabanus* and *Hybomitra*. Nearly all deer flies are in the genus *Chrysops*.

### How Can I Recognize a Horse Fly or Deer Fly?

Adult horse flies (Fig. 1) and deer flies (Fig. 2) are relatively large to very large (approximately 0.25 to 1.25 inches long), robust flies with a pair of huge eyes known as “compound eyes.” Those of some horse flies have colorful purple or green bands against a blue or yellowish-green background. The mouthparts are large and prominent, projecting downward and forward in front of the head. They have large, fan-shaped wings and are capable of rapid flight and flying long distances.

### Structural and Behavioral Differences of Horse Flies and Deer Flies.

Feature	Horse Flies	Deer Flies
Size (length)	Most species 0.5 to 1.25 inches	Nearly all species 0.25 to 0.33 inches
Antennae	Shorter than head, with a thick base	Longer than head, nearly uniformly slender
Wings	Clear or uniformly cloudy	Dark bands or patches on a clear background
Feeding behavior	Most species don't bite humans	Most species will bite humans
Feeding behavior	Will bite stationary animals	Typically only bite moving animals



Figure 1. A horse fly, *Tabanus* sp. (Diptera: Tabanidae), adult female. (Photo by: Drees, Univ. of Texas)



Figure 2. A deer fly, *Chrysops* sp. (Diptera: Tabanidae), adult female. (Photo by: Drees, Univ. of Texas)

### What Is the Life Cycle of Horse and Deer Flies in Indiana?

Similar to all flies, horse and deer flies develop from egg to adult via a process of “complete metamorphosis.” This means the last larval stage passes through a non-feeding pupal stage, from which the adult eventually emerges.

The summarized life cycle of horse flies (Fig. 3) and deer flies (Fig. 4) begins with the emergence of adults from late spring into summer, depending on the species. Upon becoming active, adults of both sexes feed on energy-rich sugars in nectar, plant sap, or honey dew produced by sap-sucking insects such as aphids and scale insects. Mating of the few species that have been observed takes place in flight. Females of some species are capable of developing an initial batch of eggs without taking a blood meal, otherwise blood is required for the development of eggs. Females search for a place to lay a single mass of eggs consisting of 100-800 eggs, depending on species. Egg masses of most species that have been studied are laid on the underside of leaves or along the stems of emergent vegetation growing in wetlands. Hatching occurs in approximately 2-3 days, and newly emerged larvae drop down into water or saturated soil in which they feed and develop.

The sites in which horse and deer fly larvae develop are known for only about a third of the species in the U. S. Deer fly larvae appear to be limited to aquatic habitats, including marshes, ponds, and streams. Developmental sites of horse fly larvae are more varied. Larvae of most species are found in freshwater and saltwater marshes, some in streams, some in moist forest soils, and a few in moist decomposing wood. Larvae of all species of horse flies that have been studied are predators. They feed primarily on other soft-bodied animals such as insect larvae and worms, but larvae of some large species of horse flies feed on small vertebrates, including tadpoles, frogs, and toads. Horse fly larvae appear to possess a toxin in their saliva that is involved in subduing their prey. Much less is known about the feeding behavior of deer fly larvae, and there is no consensus as to whether they are predators or scavengers.

The larval stages of horse and deer flies range in number from 6-13. The last larval stage passes winter in the site in which it developed and molts into a pupa the following spring. Most species complete one generation per year. However, small species of deer flies can complete 2-3 generations per year and very large species of horse flies require 2-3 years in which to complete larval development.

### What Should I Know About the Feeding Behavior of Adult Horse and Deer Flies?

Only females take a blood meal, and, with rare exception, they feed during the daytime. Unlike numerous other groups of blood sucking flies, female horse and deer flies do not enter structures and thus do not feed on humans indoors. Female horse flies feed primarily on large mammals, including stationary hosts, and they typically bite the legs and body, rarely on the head. Although there are species of horse flies that feed on humans, Indiana species rarely do. In contrast to horse flies, female deer flies typically feed on moving hosts and usually bite on the shoulders and head. They have a wide host range, attacking mammals of all sizes, including humans, and some species feed on birds and reptiles. Females of both horse and deer flies are aggressive, persistent feeders that quickly return to bite again if they are interrupted before they take a complete blood meal.

Similar to other blood sucking insects, female horse and deer flies respond to chemical and visual cues associated with a potential host. Carbon dioxide given off by warm-blooded animals provides a long-range cue, attracting females into the vicinity of a host. There, visual cues such as motion, size, shape, and dark color serve as attractants. Female horse and deer flies are deterred very little by repellents, including DEET, and humans entering infested areas have little protection against them.

### How Do Humans Influence Horse and Deer Fly Development?

Humans generally do not influence horse and deer fly development because habitats that support larval development are “natural,” including freshwater wetlands, saltwater marshes, and open areas within forests. However, there is one type of habitat associated with human activity that can be

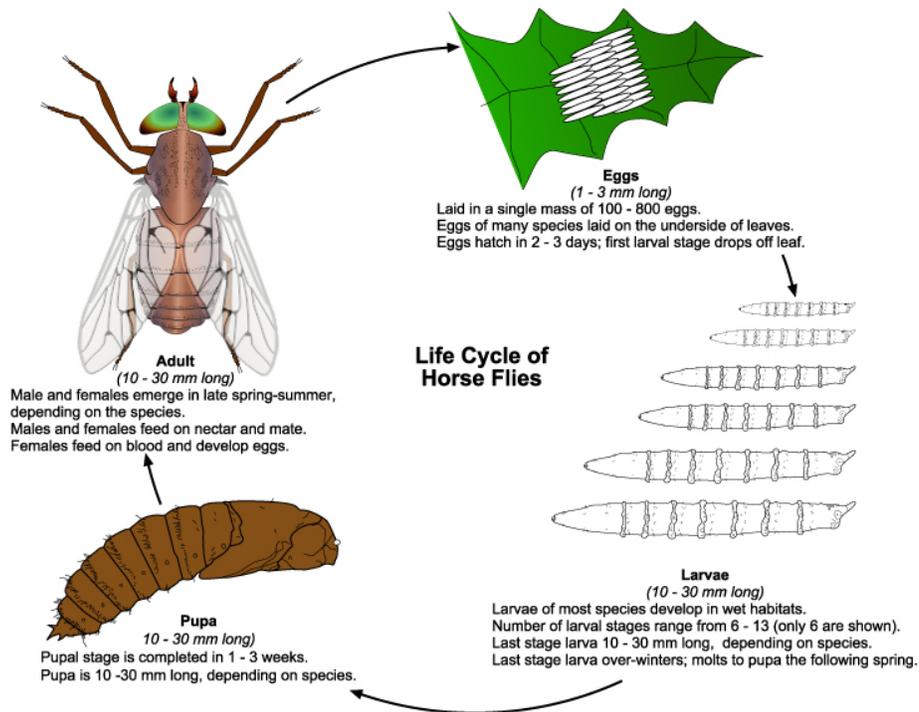


Figure 3. Summarized life cycle of horse flies.

(Drawing credit: Scott Charlesworth, Purdue University, based in part on Pechuman, L.L. and H.J. Teskey, 1981, IN: *Manual of Nearctic Diptera*, Volume 1)

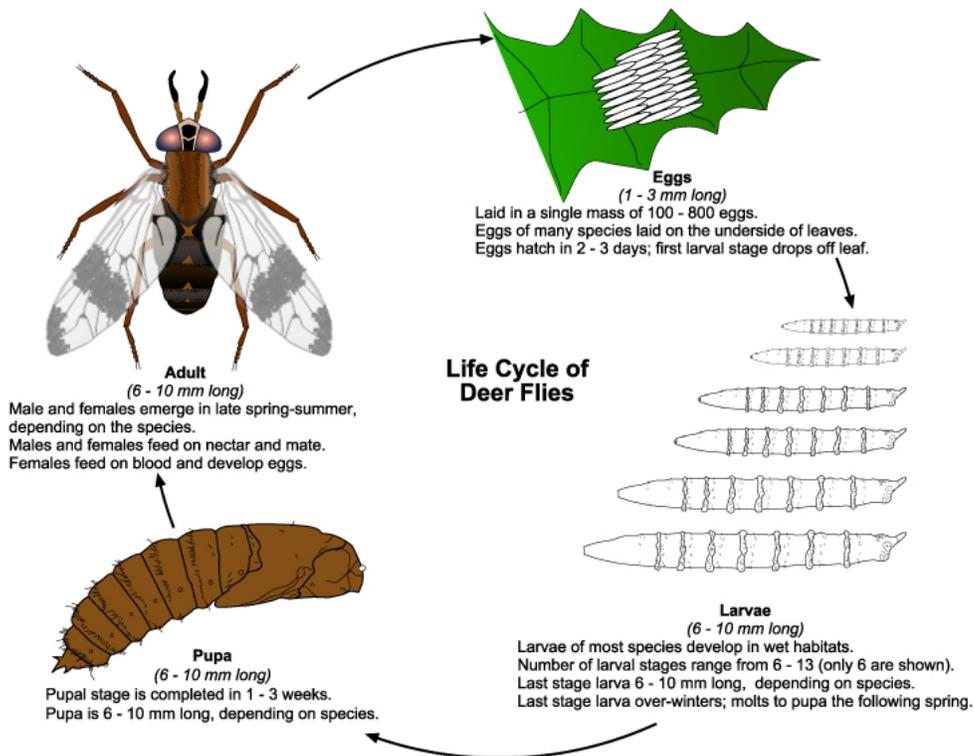


Figure 4. Summarized life cycle of deer flies.

(Drawing credit: Scott Charlesworth, Purdue University, based in part on Pechuman, L.L. and H.J. Teskey, 1981, IN: *Manual of Nearctic Diptera*, Volume 1)

a source of horse flies. Larvae and pupae of a few species are able to complete development in low areas of pastures or cultivated fields that support standing water or at least consist of heavily saturated soils.

### **Are There Effective Methods of Controlling Horse and Deer Flies?**

Controlling horse and deer flies is nearly impossible. The use of insecticides to kill larvae is not an option because the vast majority of species develop in natural habitats in which insecticides cannot be applied due to environmental concerns. Even if they could be used, insecticides would be ineffective in controlling larvae because they are widely dispersed in a developmental site. The use of insecticides against adult horse and deer flies is not a realistic option because they are relatively large to very large and unaffected by the rate of insecticide that can be applied according to product label. At best, an insecticide application aimed at adults might produce a minor and temporary reduction in biting. A number of trapping devices have been used to capture adults, but their value is limited to sampling. At best, trapping devices produce temporary, minor relief from female horse flies.

Again, repellents, including those containing DEET, have very little or no effect in deterring adult horse and deer flies. Wearing a thick long sleeve shirt, thick pants, and a heavy hat may provide some protection against bites when entering habitats that support large numbers of adult horse and deer flies, but females can be very annoying as they attempt to take blood meals.

### **Where Can I Find More Information About Horse and Deer Flies?**

There is surprisingly little information about horse and deer flies on university and governmental Web sites. There is, however, a recent textbook (2002) by G. Mullen and L. Durden, *Medical and Veterinary Entomology*, that includes an excellent chapter devoted to horse and deer flies, covering biology, behavior, and medical and veterinary risk. It also includes a section that evaluates various methods used in attempts to control horse and deer flies.

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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