



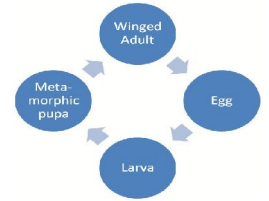
MISSOURI BOTANICAL GARDEN

William T. Kemper Center for Home Gardening

Visit us on the Web: www.gardeninghelp.org

Insect Order ID: Diptera (Flies, Gnats, Midges, Mosquitoes, Maggots)

Life Cycle—Complete metamorphosis: Adults lay eggs. Eggs hatch into larvae (maggots, wigglers, etc.). Larvae eat, grow and molt. This stage is repeated a varying number of times, depending on species, until hormonal changes cause larvae to pupate. Inside the pupal case the pupae change in form and in color and develop wings. The emerging adults look completely different from the larvae.



Adults—All (except a few wingless species) have only one pair of membranous wings, thus the name Diptera meaning "two wings". The forewings are fully developed and functional, while the hindwings are reduced to knobbed clubs called halteres, which are difficult to see without magnification except for larger specimens (e.g., crane flies). They are the best fliers in the insect world and possibly beyond: they can hover, fly backwards and upside-down and turn on the spot. Their eyes are usually large and multi-faceted, with males usually having larger eyes than females. Although many mimic bees and wasps, none have stingers. The order Diptera comprises two main suborders: long-horned (Nematocera) and short-horned Brachycera). Nematocera have long legs, long antennae and look fragile (e.g., mosquitoes, gnats, and midges, etc.) while Brachycera have stout bodies and short, stout antennae (e.g., horse flies, house flies, robber flies, hover flies, etc.). *(Click images to enlarge or orange text for more information.)*



Large, multifaceted eyes



One pair of wings



One pair of halteres



Robust-looking Brachycera



Short, stubby antennae (Brachycera)



Fragile-looking Nematocera



Many species are tiny (Nematocera)

Eggs—Adults lay eggs, usually where larval food is plentiful. Eggs may hatch quickly or go through a period of dormancy. *(Click images to enlarge or orange text for more information.)*

Larvae—Most are vermiform (worm-like) maggots with no legs, no prolegs, no wings, no wingbuds, and often lacking eyes and a discernable head. They are narrower at the head and broader at the rear. Mouthparts are reduced to two hooks with which they "bite." They are considered to have chewing mouthparts. The larvae of mosquitoes are called wigglers. They are aquatic and have a distinct head, prominent eyes, and jaws that can chew. *(Click images to enlarge or orange text for more information.)*



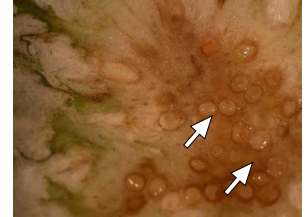
Vermiform
(Worm-like)



No legs, no prolegs



Usually hidden



Here, inside a bud gall

Pupae—All Diptera have a pupal stage, during which the adult, winged form develops. Some pupae are in a silk cocoon; others remain inside the hardened larval skin (coarctate pupa). When the adult emerges from the pupa, it has wings, is fully grown and fully developed, and looks completely different from the larva. *(Click images to enlarge or orange text for more information.)*



Head at small end



Coarctate pupa



Empty pupal cases

Beneficial/Benign Aspects—Most species are predators or parasites of garden pests, important pollinators, or vital members of the decay process of both plant and animal debris. *(Click images to enlarge or orange text for more information.)*



Pollinators



Pollinators



Parasites



Predators



Predators



Decay organisms

Damage—Damage to plants is usually by the larvae which feed inside plant tissues as leaf miners, borers or gall makers. Adults feed on liquids only (usually sugar in the form of nectar or honeydew, feces, or blood) or do not feed at all. Their primary damage to people and livestock is as biting pests and as disease vectors. They carry malaria, yellow fever, dengue fever, St. Louis encephalitis, West Nile virus, etc. Their mouthparts are varied and highly specialized. Some Nematocera adults (e.g., mosquitoes) have stabbing-siphoning mouthparts. The lower lip of most Brachycera adults is enlarged and sponge-like. The common housefly and certain other flies spit on their food to liquify it, then sponge it up. Others, such as horse flies and deer flies, also have scissor-like mandibles, while still others, such as, stable flies, also have toothed mouthparts that cut the skin of their prey. No adult fly chews its food. The larvae (maggots) have mouth hooks that tear plant or animal tissue and is considered a chewing mouthpart. Mosquito wigglers also, chew their prey. *(Click images to enlarge or orange text for more information.)*



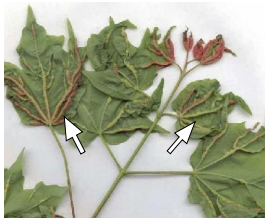
Leafminer (damaging)



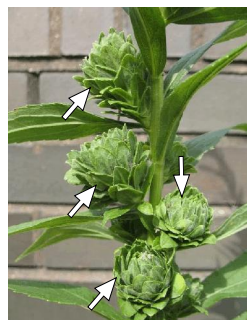
Leafminer (cosmetic)



Fruit maggot



Vein gall (cosmetic)



Bud galls
(damaging)



Leaf gall (cosmetic)



Fungus gnats

Comments—Diptera is the second largest order of insects and may eventually prove to be the largest as more species are discovered.

The word "fly" in the common name of true Dipterans is spelled as two words (e.g, fruit fly) while fly in the common name of non-Dipterans is spelled as one word (e.g., butterfly).