

Lecture 11: Siphonaptera and Diptera

Siphonaptera: The fleas



Cat flea adult (left) and larva (right)

Siphon = tube; aptera = wingless

Web sites to check:

Siphonaptera (at The Wonderful World of Insects)

Catflea

Description and identification:

Adult:

- Mouthparts: sucking
- Tarsal segments: 5
- Size: minute
- Wings: none
- Distinguishing characteristics: Sucking mouthparts; body compressed laterally; bristles and setae on long legs modified for jumping. Genal and pronotal combs are important in identification.

Larvae:

- White, cylindrical, with visible head capsule; legless; long setae on thorax and abdomen; 2 small hooks at rear of abdomen; eat various forms of organic material (including dried host blood in adult flea feces).

Metamorphosis: Complete (Adults may remain dormant within the pupal covering until vibrations (signs of the possible presence of hosts) trigger emergence).

Similar orders: Phthiraptera (not laterally compressed; legs not modified for jumping).

Habitat: Adults on host animals. Larvae in nests and similar materials (carpets and pet bedding).

Pest or beneficial status: Pests of humans and domestic animals; vectors of plague and other diseases

The odd nature of the transmission of bubonic plague: Rats and other rodents serve as the reservoir for the plague bacterium, *Pasteurella* (= *Yersinia*) *pestis*. The oriental rat flea, *Xenopsylla cheopsis*, feeds on infected rodents, and the bacterium multiplies in the flea's digestive tract, blocking the gut. The fleas continue to try to feed, but must regurgitate the contents of their gut to do so. In so doing, they introduce the bacterium into the new feeding wound, infecting a new host (person or animal). This is the disease called the black death that periodically exploded in huge epidemics in Europe in the Middle Ages.

Diptera: The flies

Di = 2; ptera = wings. The 2-winged insects.

"Fly" is written as a separate word for this order.

Web sites to check:

[Diptera](#) (at The Wonderful World of Insects)

[The Diptera at The Tree of Life](#)

[Diptera at the USDA Systematics Laboratory](#)

Description and identification:

Adult:

- Mouthparts: sucking (incl. sponging)
- Tarsal segments: 5
- Size: minute to large
- Wings: 2 (or none in a few species); membranous; hind wings modified as knob-like halteres
- Distinguishing characteristics: Antennae in Nematocera are filiform or feathery; in the Brachycera, short and horn-like; in the Cyclorrhapha, hairlike.

Larvae:

- All are legless. In the Nematocera, there is a true head capsule; in the Brachycera, either a partial head capsule or no head capsule at all (in what was once recognized as the suborder Cyclorrhapha). Larvae without a head capsule are accurately called maggots, and the only sclerotized (hardened) organs at the head are one or two mouth hooks. Maggots pupate within the last larval "skin" that is hardened to form a puparium.

Metamorphosis: complete

Similar orders: Hymenoptera (but Hymenops have 4 wings)

Habitat: Virtually every habitat -- aquatic, in vegetation, insect predators and parasites, vertebrate parasites (external and internal)

Pest or beneficial status: Important pests of humans and animals; mosquitoes carry several devastating human diseases; some plant pests (apple maggot, for example); also beneficial parasites and predators (syrphids or hover flies).

2 suborders: Nematocera and Bracycera (Brachycera includes the prior-recognized suborder Cyclorrhapha)

Nematocera:

In the **Nematocera** (the long-horned flies), the suborder that contains the mosquitoes, black flies, and many midges, the antennae are long, with 9 or more segments. In some groups the antennae are feathery. Common families include the Cecidomyiidae (gall midges), Culicidae (mosquitoes), Tipulidae (crane flies), Chironomidae (midges), Psychodidae (moth flies, sand flies, sewer flies), and Sciaridae (dark-winged fungus gnats). In the Tipulidae, the halteres are especially easy to see.

Cecidomyiidae: The gall midges, includes the Hessian fly

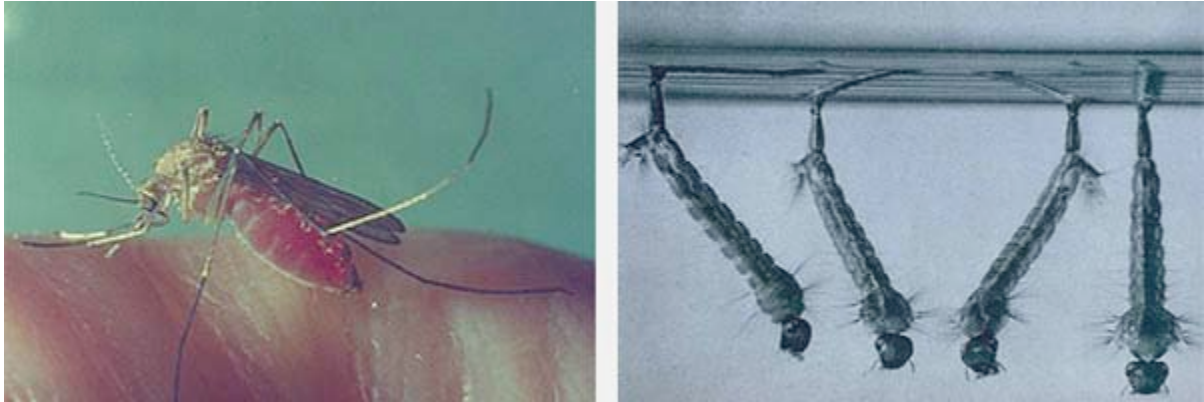
- Delicate, long legs, long antennae, reduced wing venation



Hessian fly adult (left) and pupae ("flax seeds") (right)

Culicidae: The mosquitoes

- Long proboscis
- Scales along wing veins
- Females feed on blood; males feed on nectar, etc. *Anopheles* spp. transmit malaria. *Aedes* spp. transmit dengue, yellow fever, others. *Culex* and other genera transmit the viruses that cause encephalitis.



Mosquito adult (left) and larvae (right)

Tipulidae: The crane flies

Crane flies look like giant mosquitoes but lack a biting proboscis. They have extremely long legs.



A crane fly (University of Idaho)

Chironomidae: The midges

Chironomids are one family referred to as midges ... you may think of them as gnats. They resemble mosquitoes but lack scales on the wings and a long proboscis; they do not bite. The front legs usually are the longest.



A chironomid midge

Psychodidae: The moth flies, sand flies, and sewer flies

Very small, hairy-bodied, moth-like flies that hold their wings roof-like over the body. Species here are often associated with decaying material in seldom-used drains. In other parts of the world, sand flies in the subfamily Phlebotominae are blood-feeders that transmit several diseases to humans.



A moth fly (Oklahoma Biological Survey).

Sciaridae: The dark-winged fungus gnats

Sciarids are usually dark colored and have long antennae. Distinguishing them from related families requires use of characteristics that we do not cover in this introductory course. Larvae feed on decaying plant matter, excrement, or fungus; some are pests in commercial mushroom facilities and in greenhouses.



A dark-winged fungus gnat (University of Minnesota).

Brachycera:

In the **Brachycera**, (the short-horned flies), the antennae are short, with five or fewer segments. Common families include the Asilidae (robber flies), Tabanidae (horse flies and deer flies), Syrphidae (hover flies), Tephritidae (fruit flies), Drosophilidae (pomace or vinegar flies), Tachinidae (tachinid flies), Calliphoridae (blow flies), Sarcophagidae (flesh flies), and Muscidae (house flies and related muscid flies). Check your text for the families not discussed below; a few other families are presented below to illustrate the diversity of the suborder.

Tabanidae: The horse flies and deer flies -- blood feeders on humans and other animals.



A deer fly

Syrphidae: The hover flies or flower flies (larvae of many species are predaceous).

- Adults resemble wasps.
- Larvae of *Eristalis* (rattailed maggots) live in manure pits, etc.

Tephritidae: The fruit flies, including apple maggot and Mediterranean fruit fly

- Spotted or banded wings



Apple maggot adults (left) and larvae (right)

Agromyzidae: leafminers

Anthomyiidae: seed corn maggot and similar species in the genus *Delia*, also some leafmining species (spinach leafminer)

Muscidae: Includes the house fly, stable fly, face fly, etc.



Stages of house fly development



House fly (left) and stable fly (right)

Tachinidae: Tachinid flies; larvae are parasitic on other insects

- [Tachinidae at the Cornell University biocontrol site](#)