

Biting Midges, No-See-Ums, Punkies

Family Ceratopogonidae; Plate 92

Different Kinds in North America — Many; 20 genera, 579 species.

Distribution in North America — Throughout.

Habitat — Lentic-littoral, lotic-depositional. There are aquatic and semi-aquatic species of biting midges. Aquatic species occur in the soft, fine sediment on the bottoms of ponds, lakes, still areas of streams and rivers, swamps, salt marshes, and tree holes. Some of the aquatic species are especially common in thick growths of algae. Semi-aquatic species of biting midges inhabit the moist sand of the intertidal zone on ocean beaches, muddy areas that are rich in organic matter (especially around barns and feed lots), and wet vegetation at the margins of the water.

Movement — Primarily burrowers, some sprawlers. Many of the common species of biting midges are very long and thin, and they move through soft sediment by wiggling their bodies like snakes. Sometimes they swim through the water by the same motion.

Feeding — Engulfer-predators, collector-gatherers. Most biting midge species with mouthparts that project forward are engulfer-predators, feeding on the larvae of non-biting midges (Diptera: Chironomidae) and other small invertebrates. Many of these also feed extensively on the eggs of other aquatic insects. Most species of biting midges with mouthparts that project down are collector-gatherers.

Other Biology — Biting midge pupae float and swim in the water. They remain in contact with the air at the water surface by means of breathing horns on the thorax. Most adult females are blood feeders on mammals and birds, but some feed on reptiles and amphibians. Some species of biting midges take the blood of large insects, such as moths or dragonflies, often by piercing a wing vein. In some species of biting midges, adult females kill small, swarming adult aquatic insects, such as non-biting midges, mosquitoes, may-

flies, and even their own species. They fly into the swarms, capture a prey, then consume its body fluids. Females of some species of biting midges feed on the male that they are mating with. Many species fly at night, especially at twilight, but some are active during the day. There can be many generations per year. Biting midges are considered pests as adults because some species attack humans. Their bite is much more aggravating than their small size would indicate, and they are difficult to keep away because they can pass through most screens and netting. Species that breed in the sand at the beach are often called sand flies, and these can be particularly troubling to the tourist industry. Although biting midges do not transmit diseases to humans in North America, some species do transmit serious diseases to livestock.

Stress Tolerance — Chiefly facultative, others somewhat tolerant.

Black Flies

Family Simuliidae; Plate 90

Different Kinds in North America — Moderate; 11 genera, 165 species.

Distribution in North America — Throughout.

Habitat — Lotic-erosional. Black fly larvae occur only in flowing waters, but different species can be found in all sizes of flowing waters from spring seeps to large rivers. Current preferences vary among species, from slow velocities along the margins of low-gradient streams to the maximum current speed in mid-channel areas of torrential streams. They attach to rocks, woody debris, vegetation, and any other stable, solid objects in the water. Larvae of black flies are also found on litter that people discard in streams, such as plastic sheeting, appliances, and parts of automobiles. Sometimes black fly larvae are so abundant that they almost completely cover suitable substrates.

Movement — Clingers. Larvae of black flies produce a silk

thread from their mouth and put a pad of this sticky material on the substrate. They then attach themselves to the silk pad by a ring of minute hooks on the posterior of their abdomen (Plate 90B). This mechanism of attachment does not work if the substrate becomes covered with a slime from excessive growths of algae, fungi, or bacteria. Black fly larvae can move slowly by alternately grabbing the substrate with the posterior ring of hooks and the soft, fleshy, unsegmented leg (proleg) on the front of the thorax. Larvae immediately let out a silk thread if they lose contact with the substrate. This serves as a lifeline to return to their original position if they are swept away.

Feeding — Collector-filterers. In most species of black flies, larvae extend fan-like mouthbrushes into the current to filter fine particles suspended in the water. Periodically they “flick” these brushes into their mouths to remove the material that has been filtered from the water. Food consists of very fine detritus, algae, and bacteria. A few kinds that lack mouthbrushes feed on the film of organic matter that accumulates on the substrate that they are attached to.

Other Biology — Black fly larvae obtain dissolved oxygen through the surface of their body. Some kinds are territorial and separate themselves by at least one body length. They use their jaws to nip at any other black fly larva that comes within reach. Others exist in dense mats of larvae with their bodies packed tightly together. There is some evidence that they use their filter-feeding mechanism to capture the feces of other nearby black fly larvae. Pupation occurs in the same habitat where the larvae develop, and pupae and larvae of the same species can often be found together. Larvae prepare a rigid, sack-like cocoon, with the open end facing downstream (Plate 90C). Black fly pupae breathe with two tufts of branched, filamentous gills on the thorax. The heads of the pupae stick out of the cocoon, and the gills trail in the current. The adult emerges from the pupa in the cocoon. As the adult black fly comes out of the pupal skin, a bubble of air forms around it and carries it to

the surface, where it flies away. Adults are known to migrate at least 80 km from where they emerge. Females of most kinds are blood feeders, and they are terrible pests of humans, livestock, and wildlife. Black flies emerge in enormous numbers, particularly in the northern United States and Canada. They fly only during day-time, and aggressively pursue their hosts in swarms. Any exposed skin is quickly subjected to many painful bites that continue to itch and ooze for a long time. In some areas, black flies practically eliminate tourism while the adults are present. They also significantly reduce profits from raising livestock because the loss of blood and constant aggravation from swarming and biting causes the animals to not gain weight, or in severe instances, to die. In the tropics, black flies transmit several debilitating diseases to humans, but in North America the diseases that they vector only affect wild and domestic animals. Most of the black fly species that bite humans most severely have ranges limited to the North. Most of the species that inhabit the South feed primarily on wild birds and mammals. Fortunately, northern species usually have only one generation per year, and the adults only emerge for 4–6 weeks in late-spring and early-summer. Many of the southern black fly species have several generations per year, and the adults emerge throughout the warm seasons.

Stress Tolerance — Primarily facultative, others somewhat sensitive. The abundance of facultative kinds of black fly larvae usually increases when moderate amounts of organic matter or nutrients are allowed to enter flowing waters. These types of pollution make more particles of food available to the filter-feeding larvae. When black fly larvae represent a majority of the community, that is a reliable indication of moderate organic or nutrient pollution. Larvae of common netspinner caddisflies (Trichoptera: Hydropsychidae) are often the other organisms that dominate under these circumstances of pollution. However, if these pollutants are so great that dissolved oxygen becomes excessively low or the substrate becomes covered with a thick growth of algae, bacteria, and fungi, then black

flies will not survive. It is ironic that when grossly polluted streams and rivers are restored to a moderately clean state, black fly larvae repopulate those waters and the biting adults begin to be noticeable pests.

Crane Flies

Family Tipulidae; Plate 94

Different Kinds in North America — Many; 34 genera, 577 species (aquatic or semi-aquatic).

Distribution in North America — Throughout.

Habitat — Lentic-littoral, lotic-erosional, lotic-depositional. This is the largest family of true flies, in terms of number of species. Crane flies are also very diverse ecologically, including aquatic, semi-aquatic, and terrestrial species. Habitats of larvae include stones, leaf packs, and woody debris in swift riffles, as well as sand, gravel, and mats of algae along the margins of streams. A few larvae of crane flies live in accumulations of algal scum on rock outcrops, where only a trickle of water keeps the site moist. They also occur in rich mud and damp decaying vegetation at the edges of many standing-water habitats, including swamps and marshes. A few kinds of crane fly larvae inhabit intertidal zones and brackish waters.

Movement — Burrowers, sprawlers.

Feeding — Primarily shredder-detritivores and collector-gatherers, some engulfer-predators.

Other Biology — Larvae of most kinds of crane flies have an open breathing system with two spiracles on a flat, slightly recessed area, at the end of the abdomen (Plate 94B). Some have a closed breathing system and obtain dissolved oxygen all over the surface of their body. Some kinds of crane fly larvae are very common in leaf packs in streams, especially the large (up to 100 mm), gray ones that are sometimes called "leather jackets" (genus *Tipula*). Their shredder-detritivore feeding habits are significant in ecosystem dynamics. They break down the leaves that fall from trees on land and make the energy and nutrients contained in the leaves

available to other aquatic organisms.

Some crane fly (genus *Hexatoma*) larvae are engulfer-predators that have an interesting behavior for feeding. None of the true flies have segmented legs that they can use to hold on to the substrate while they catch and subdue live prey. These particular crane fly larvae can form a large knot with the muscles at the end of their abdomen. When they catch an organism with their mouthparts, they enlarge the end of their abdomen and wedge the knot between stones in the riffle where they reside. Crane fly larvae do not leave the water to pupate (Plate 94C), but they do move to wet sand or gravel along the edge of their habitat. Adults probably feed on nectar. They do not feed on blood. Most kinds of crane flies produce one generation per year, but a few require 2 years to complete a generation.

Stress Tolerance — Mainly facultative, others somewhat sensitive to somewhat tolerant. The crane fly family is so ecologically diverse that different tolerances to stress are expected.

Dance Flies

Family Empididae; Plate 98

Different Kinds in North America — Moderate; 16 genera, 294 species (aquatic or semi-aquatic).

Distribution in North America — Throughout.

Habitat — Lotic-erosional, lotic-depositional, lentic-littoral. Most species of dance flies are terrestrial, and the aquatic species have not been studied very much. Most aquatic species live on the bottom of swift streams down to a depth of 1 m. Larvae of dance flies are found on rocks as well as in moss. Some live in wet marginal areas of streams and ponds, even in stagnant water. A few kinds of dance flies inhabit the surfaces of firm substrates that are covered with just a thin film of flowing water.

Movement — Primarily crawlers; also sprawlers, burrowers, and clingers.

Feeding — Primarily engulfer-predators, perhaps some col-