



Stream Team Academy
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Watch for more Stream Team Academy Fact Sheets coming your way soon. Plan to collect the entire educational series for future reference! Contact us at 1-800-781-1989 if you'd like a copy of previous Fact Sheets or a binder to store them in.

LIFE CYCLES & NATURAL HISTORY OF AQUATIC INSECTS

Part 2 – The Mayflies (Ephemeroptera)

An Educational Series For Stream Teams To Learn and Collect

By Paul Calvert

Although the Ephemeroptera (mayflies) are among the most primitive aquatic insects in the world, they are also arguably one of the most popular of the aquatic insects. The adult's wings do not fold over like other insect wings, leaving the characteristic triangular wings pointing straight up over their back. Although they all look similar, we will see that they have very diverse and complicated life cycles. There are 22 families in the United States, and 15 are found in Missouri.

LIFE CYCLES

Their name implies short-lived (ephemeral), and this is demonstrated in the adult phase, lasting from a short two hours up to three days. The adult stages exist only for reproduction and dispersal. Because of this, they have undeveloped mouthparts and are unable to feed.

Mayflies mate in swarms dominated by males. Females fly into the swarm,

select a mate, copulate, and then leave the swarm to deposit their eggs. Most deposit eggs by dipping their abdomen into the water as they fly. However, some land on rocks and dip their ovipositors into the water, some submerge, and others drop eggs from the air. Eggs are deposited a few at a time or all at once and separate when they come into contact with the water. The number of eggs laid ranges from 100 to 12,000 per female, with the average range being 500 to 3,000.

Most eggs begin developing immediately upon contact with the water. A synchronized hatch occurs if the eggs were laid all at once. A staggered hatch occurs if eggs were deposited a few at a time. This stagger may only be a few hours but, this time-lag may benefit the species. Eggs in some species hatch immediately upon being deposited in the water, speeding up their life cycles to take advantage of ephemeral habitats. In others, the eggs may go through a diapause, a period of time when development stops, for up to 11 months.

Mayflies have an incomplete life cycle, or are hemimetabolous. When the eggs hatch, the nymphs molt 12 to 45 times depending on the species and the temperature of the water, completing development in as short as two weeks or as long as two years. The final wingless nymphal stage molts to a winged form called a subimago or dun. This form is still sexually immature in most species. These forms are generally dull in color and have opaque wings. This life stage makes mayflies unique. All other insects



Although mayflies are generally considered sensitive organisms, some species are more tolerant and can handle lower oxygen environments.

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molt directly to a sexually mature winged form or pupate before emerging as a winged adult. This stage may last just a few minutes or up to a day or two before the final molt into the shiny-bodied, transparent-winged adult takes place.

HABITAT

It is believed that mayflies evolved in cold water streams, and many of the more primitive species are still restricted to these habitats while others have adapted to all stream types. Some can even be found in lentic (non-flowing) habitats like temporary pools, lakes, and wetlands. Although we teach that the mayflies are sensitive to poor water quality, some can tolerate fairly low dissolved oxygen levels.

They are also very diverse in where they can be found in their habitat. They can be climbers on vegetation, burrowers into the substrate, swimmers, or clingers on rocks and logs.

FEEDING

Most experts classify mayfly nymphs as grazers, or scrapers, and diets are composed of algae and detritus. However, some have been documented as predaceous and others have adaptations for filter feeding.

RESPIRATION

Mayfly nymphs have paired tracheal gills on the lateral

or dorsal surface of their abdominal segments. Most mayflies rely on stream flows to renew oxygen on their gill surfaces. These species are restricted to streams and, in many cases, cold or cool water streams where there is a higher percentage of dissolved oxygen. Some have modifications that allow them to move into previously hostile habitats. An example of this is the modification of one set of gills into gill covers, allowing that species to live in areas where previously, injuries to the gills restricted them from that habitat. Others have developed behavioral traits of moving or fanning their gills to regulate oxygen intake, allowing some species to survive in habitats lower in dissolved oxygen. Others, like the burrowing mayflies, have behavioral traits that allow them to live in substrates made up of fine particles such as sand, silt, and mud. They use a slow fanning motion to circulate food and oxygenated water through their burrows.

CONCLUSION

Although they are very primitive and are considered to be sensitive to changes in water quality, mayflies can be found in many aquatic resources, both lentic (standing water) and lotic (flowing water). When you are monitoring, remember that although many species of mayflies are sensitive, there are some that can live in poorer quality waters.

Our next fact sheet will cover the stoneflies, our most sensitive group of aquatic insects. Don't forget to send your questions to streamteam@mdc.mo.gov or call 1-800-781-1989.

Sources:

Freshwater Macroinvertebrates of Northeastern North America. Barbara L Peckarsky et al. 1990.

Aquatic Entomology—the Fishermen's and Ecologists' Illustrated Guide to Insects and Their Relatives. W. Patrick McCafferty. 1998.



Adult mayflies are a familiar sight during summer months. Adults don't have mouth parts and live only long enough to mate and lay their eggs. Photo courtesy of Jason Neuswanger, Troutnut.com.