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Collect this 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 for storing them.

LIFE CYCLES & NATURAL HISTORY OF AQUATIC INSECTS

Part 6 – The Dragonflies and Damselflies (Odonata)

An Educational Series For Stream Teams To Learn and Collect

By Paul Calvert

Odonates are among the most ancient flying insects. Their ancestors appeared during the Carboniferous period, some 300 million years ago. These early dragonflies had wingspans of almost 30 inches, more than four times that of the largest dragonflies today. Odonates have two suborders, the Anisoptera (dragonflies) and the Zygoptera (damselflies). Adult dragonflies hold their wings horizontally when at rest, while adult damselflies hold their wings vertically over their back when at rest. Odonates are one of the most studied groups of aquatic insects and very little remains unknown about their natural history and life cycles.

LIFE CYCLE

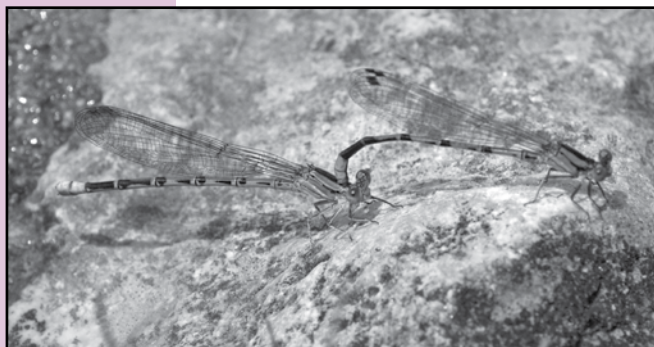
The mating behavior of Odonates has received much attention throughout the scientific world. Males of both dragonflies and damselflies are very territorial and spend significant amounts of time defending prime ovipositing sites near ponds or streams. Female dragonflies that fly into these territories are grabbed by the males, who hold on to the females with their legs until they can grasp them

behind the head using appendages at the end of their abdomen. Female damselflies are grasped in a similar manner around the prothorax or upper portion of the body, close to the head. This activity is called tandem flight.

Odonates are peculiar in that the male copulatory organ is found on the second abdominal segment, or on the anterior portion of the abdomen. However, the genital opening is found at the opposite end of the abdomen on the ninth segment. Before copulation occurs, sperm is transferred from the genital opening to the copulatory organ. This frees up the posterior end of the abdomen and allows the male to hold on to the female. During tandem flight, once the female is secured around the neck or prothorax, she responds by bending her abdomen down and forward, coming into contact with the copulatory organ of the male. This creates the characteristic “wheel” position drawn and photographed by Odonate lovers.

Tandem flight can continue through egg laying but does not always. In cases where tandem flight is not continued, males will remain close to defend the female from other males until her eggs are laid.

Some species insert their eggs into the plant material of emergent or submergent vegetation. Others deposit them on the surface of vegetation, on sand or silt under the water, or on the water surface. Depending on the species, the number of eggs laid could be from a few hundred to as many as a few thousand. Eggs hatch within 12 to 30 days, depending on water temperature. If eggs were laid in a dry basin or the basin dries before the eggs hatch, growth is suspended (diapause)



A pair of *Argia plana* damselflies in tandem. Note the wings held together vertically above their backs. Photo courtesy of Jon Rapp, Stream Team 327.

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and development will continue when reflooding occurs.

Odonates are hemimetabolous, undergoing simple metamorphosis. They generally overwinter as eggs or nymphs and undergo 10 to 16 molts. Their life cycle can be repeated numerous times in a year (multi-voltine), once per year (univoltine), or may take as many as five years to complete. Adults are relatively long-lived, with a lifespan of several weeks to several months.

HABITAT

Odonates are typically found in lentic (non-flowing) habitats like ponds, marshes and wetlands where they burrow into the sediment or climb around on submerged vegetation. A few species inhabit lentic (flowing) systems where they are generally found in backwater areas, rootwads, leaf litter, or submerged vegetation.

FEEDING

Odonates are predacious from the time they hatch until they die. Nymphs use their modified labium, or mask, that extends out and their well-developed compound eyes to capture other macroinvertebrates and even small vertebrates for food. While their tools are similar, their methods vary. Some nymphs use ambush methods to collect prey while others stalk.

Adults feed on small flying insects like mosquitoes and midges. This is done on the fly, with adults spending most of their day in flight.

RESPIRATION

Dragonfly nymphs respire through rectal expansion and contraction, moving water in and out of the anus. The rectal chamber is highly modified with rows of minute tracheal gills and

gas exchange occurs through the thin-walled cuticle of the gills. This rectal expansion and contraction is also used for jet-propulsion by rapidly expelling water from the rectal chamber. Damselfly nymphs have three caudal lamellae on their posterior end that serve as tracheal gills as well as swimming structures.

CONCLUSION

Odonates do not serve as important a role as indicators of water quality as the EPT taxa. However, both immatures and adults play a very important ecological role in aquatic and terrestrial systems, where they are voracious mid-level predators.

They are also important culturally and socially. Adults are conspicuous and colorful fliers with their long slender shape. Throughout history they have been given unique names like “snake doctors,” “mosquito hawks,” or “devils darning needles.” These names are steeped in tradition, folklore, and superstitions around the world and here in the United States. They have also been mimicked in science fiction thrillers to depict alien creatures, proving that nature can be more terrifying than our own imagination.



*A pair of *Celithemis eponina* dragonflies in the "wheel" position. Photo courtesy of Jon Rapp, Stream Team 327.*



*A nymph of the dragonfly species *Neurocordulia molesta* with labium extended. Photo by Amy Meier, Missouri Department of Conservation.*

Our next fact sheet will cover the Dobsonflies (Megaloptera). 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.