

The Odonata are the dragonflies and damselflies. The common name of the order means toothed or jaw, and refers to the toothed structure of the mandibles. They have hemimetabolous metamorphosis. The adults are medium-sized to large with long slender bodies and relatively large elongate membranous wings with many veins. Their head is hypognathous with external chewing mouthparts. They have very large compound eyes with numerous facets (up to 30,000 per eye), and 3 dorsal ocelli. The antennae are very short and setaceous.

There are 2 pairs of wings which are membranous with many veins. This family, along with the Ephemeroptera, belongs in the **Paleoptera**, which are the insects that are unable to fold their wings back over their backs. Remember the Ephemeroptera held their wings vertically over their backs. The Odonata either hold them vertically over their backs, or horizontally out to the sides (not folded over the backs). The remaining orders of insect do have the ability to fold or flex their wings back over their backs and belong to a group called the **Neoptera**.

Once again, the venation of the wings are an important character for the classification of the dragonflies and damselflies. Unlike the mayflies, however, the important characters are somewhat easier to see. There are a number of different terms associated with these characters that I need to introduce you to:

- a. antennodal cross veins - cross veins along costal border of wing, between base of wing and nodus, extending from costa to radius (Fig. 10-5, an).
  - b. nodus - strong cross vein near middle of costal border of wing (Fig. 10-5 to 10-7, nod). The costal border is often somewhat indented or angled at the nodus.
  - c. stigma - thickening of wing membrane along costal border near apex (Fig. 10-5 to 10-7, st), often pigmented.
  - d. brace vein - slanting cross vein just behind proximal end of stigma (Fig. 10-7E, bvn). Some specimens appear to have brace vein in one forewing; examine all wings.
  - e. arculus - basal cross vein between radius and cubitus (Fig. 10-5 to 10-7, arc).
  - f. triangle - small triangular cell or cells near base of wing (Fig. 10-5, 10-7, tri). Anterior to the triangle is a long, narrower triangular space. In some species, the triangles are of the same shape and are oriented in the same direction in both wings, whereas, in other species the shape and orientation is different between the two wings.
- a. anal loop - group of cells in the hind wing of dragonflies, between  $Cu_2$ , 1A, and 2A, which may be rounded (Fig. 10-7B, alp), elongate (Fig. 10-7C, alp), or foot-shaped (Fig. 10-5, alp).
  - d. bisector - vein down middle of anal loop with row of cells on each side.

The legs are short and spiny with 2-segmented tarsi, and 2 post-tarsal claws.

The abdomen is elongate and slender; the male has the gonopore on the 9th abdominal segment, but they have a complex secondary penis on the ventral surface of the 2nd abdominal segment (fig. 10-4A, gen). The male transfers the sperm from the posterior gonopore to the secondary penis. It then grasps the female behind the head or on the prothorax with the 1-segmented claspers located at the posterior gonopore. The female (usually in the air) then curves her body around toward the male and hooks it to the male's secondary penis where the sperm is transferred. This is called the wheel position. Some families have an ovipositor while others do not. The damselflies and some of the dragonflies (Aeshnidae) lay their eggs by inserting them in the tissue of aquatic vegetation. Others just drop the eggs in the water, or they tap the end of their abdomens to the surface of the water and a few eggs will be washed off.

The Odonata are carnivorous, both as adults and immatures. The adults eat other flying insects such as mosquitoes and gnats. The naiads feed on small aquatic insects, small tadpoles, and occasionally small fish fry. The adults (at least the dragonflies) are very good fliers, many are very difficult to catch. This is also partially due to their good eyesight. Best way to catch them is to swing at them from behind. Also, they tend to defend territories and many of them seem to have “favorite” perching spots. If you watch carefully, you can pick out these spots and sneak in for the catch.

There are fossils from about 250 million years ago of a dragonfly that had a wingspan of about 28 inches (that's over 2 foot across!).

The Odonata are divided into 2 suborders: the Anisoptera (dragonflies) and the Zygoptera (damselflies):

**Anisoptera:** The name Anisoptera means not (An-) equal (-iso-) winged (-ptera), and refers to the bases of the wings not being the same. The dragonflies hold their wings horizontally at rest, they have the hindwings broader at the base than the forewings; they have the compound eyes larger and placed relatively close together; and the males have 3 terminal appendages (a pair of cerci and a single epiproct, but the epiproct may be bifid). The head is usually not wider than the thorax. The females may or may not have an ovipositor. The immatures of the Anisoptera are generally broader and stouter in shape, and they lack the leaf-like gills at the posterior end of the abdomen - their gills are in the form of ridges within the rectum (so when a dragonfly naiad breathes, it takes water into the rectum and removes the oxygen, then expels the water). It can use this expulsion of water from the rectum to move quickly - like jet propulsion.

**Zygoptera:** The name Zygoptera means yolk (Zygo-) winged (-ptera) and refers to the narrow bases of the wings. The damselflies usually hold the wings vertically at rest; the bases of both pair of wings are similar to each other; the compound eyes are somewhat smaller and usually much farther separated; and the males have 4 terminal abdominal appendages (a pair of cerci and a pair of paraprocts). The females have an ovipositor. The head is usually wider than the thorax. The Zygopteran naiads are longer and more slender in shape, and they possess 3 leaf-like gills at the posterior end of the abdomen; they can also use these gills to swim - sort of like fins.

### SUBORDER ANISOPTERA

A. Superfamily Aeshnoidea: The triangles in front and hind wings are similar in shape and about equidistant from arculus (Fig. 10-7A). Most of the antenodal costal and subcostal cross veins are not lined up. There is usually a brace vein behind the proximal end of stigma. Your text includes 3 families that would belong in this superfamily (Petaluridae, Aeshnidae, and Gomphidae); we will discuss 2 of them.

1. Family Aeshnidae: These are commonly called the darners. There are 5 species in North Dakota. These are often blue or green in color. These in general are the largest dragonflies and are usually relatively easy to recognize by the large compound eyes that meet dorsally on top of the head for some distance. The triangles of both wings are of a similar size and shape, and the stigma has a brace vein. The females have ovipositors and insert the eggs into plant tissue just below the surface of the water.

Most aeshnids are diurnal (daytime fliers), but some are crepuscular (fly at dawn or dusk). These are some of the best fliers and are probably the most difficult to catch. They are often found around ponds or marshes.

2. Family Gomphidae: These are commonly called club-tails, because the tip of the abdomen is often enlarged or club-shaped. There are 3 North Dakota species. The triangles in the two wings are similar in size and shape; the stigma does have a brace vein; and the compound eyes do not meet dorsally. These are usually dark in color, and are often marked with yellow or green; almost all

species have clear wings. The females lack ovipositors. The adults of this family generally occur along streams or lake shores.

B. Superfamily Libelluloidea: The triangles in front and hind wings are usually not similar in shape, triangle in front wing farther distad of arculus than triangle in hind wing (Figs. 10-5, 10-7B, C). Most of antenodal costal and subcostal cross veins lined up. No brace vein behind proximal end of stigma.

1. Family Libellulidae: These are sometimes called the common skimmers. There are 19 North Dakota species in 6 genera. They are the most commonly encountered dragonfly family, in fact, probably 8 out of 10 dragonflies you catch will probably be a Libellulidae. They are most easily recognized by the shape of the anal loop. The anal loop is shaped like a foot with a distinct "toe" region. Males without small lobe on each side of 2nd abdominal segment. The hind margins of the compound eyes are usually straight. They also have the triangles not similar in size or shape; the stigma does not have a brace vein; the inner margin of the hind wing is rounded; and the compound eyes do not meet dorsally. The wings are often marked with spots or bands. Often the males and females have very different color patterns. There is no ovipositor in the females; they just drop eggs in the water or on surface near plants. These are often fairly showy species.
2. Family Corduliidae: These are sometimes called cruisers, emeralds, or green-eyed skimmers. There are two North Dakota species. These are generally black in color, and usually lack any pale coloration. This family is most easily recognized by the shape of the anal loop which is elongate-slender in shape (Corduliinae [emeralds] - sometimes somewhat foot-shaped, but without a distinct toe), or it is circular in shape (Macromiinae [cruisers], or used to be the family Macromiidae which has now been incorporated into this family). Those species with an elongate anal loop have a vein going right down through the middle splitting the loop into 2 relatively equal parts; this vein is called a bisector; the Macromiinae anal loop lacks a bisector vein. The hind margins of the compound eyes are usually slightly lobed. Males have a small lobe on each side of second abdominal segment. They also have the triangles not similar in size and shape; the stigma lacks a brace vein; the inner margin of the hind wing is somewhat notched; and the eyes do not meet dorsally. The females lack ovipositors. Most species occur around bogs, ponds, or small streams.

### SUBORDER ZYGOPTERA

1. Family Calopterygidae: These are commonly called the broad-winged damselflies. There are 2 North Dakota species. Some older works called this family the Agrionidae. These can be recognized by several characters: they have 10 or more antenodal cross veins; the wings are not stalked, but rather are evenly tapered at base; they have numerous cross-veins; the wings and body are often dark blue or green or sometimes they are marked with red, sometimes they are somewhat metallic. The wings at rest are held vertically over body. These are usually found around smaller creeks and streams where there is lots of shade from trees growing along the shores.
2. Family Lestidae: These are called the spread-winged damselflies. There are 6 North Dakota species. These damselflies have 2 (or sometimes 3) antenodal cross veins, and the wings are stalked at the bases. The  $M_3$  arises nearer the arculus than the nodus. At rest the body is held vertically with the wings held partially divergent, and hence the common name spread-winged damselflies. These generally occur around swamps.
3. Family Coenagrionidae: These are called the narrow-winged damselflies. There are 26 North Dakota species. This is the most common family of damselflies. The females are usually differently colored than the males, but not always. They also have just a few antenodal cross veins, but the  $M_3$  arises nearer the nodus than the arculus. These also hold their wings vertically when at rest. The adults occur around a variety of habitats including ponds, lakes, streams, and rivers. They are fairly weak fliers.

