

LECTURE 23 - NEUROPTERA

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Introduction and Classification:

* Neuroptera means nerve winged.

* The Neuroptera are **Holometabolous** (have complete metamorphosis). This group is also often called the **Endopterygota** meaning that the wings develop internally. They also belong in the **Neoptera** (insects with the ability to flex their wings).

Characters:

* Individuals in this order are small to large. They are usually **delicate** insects, with 4 delicate membranous wings.

* They have **filiform** antennae with many segments.

* The wings are held roof-like over the body when at rest in most cases. Wing venation is **primitive** with the addition of **accessory veins**. There are usually numerous cross veins between the costa and the subcosta, and there are usually many parallel branches off the radial sector. The front and hind wings of our species are similar in shape and venation.

* The mouthparts are mandibulate.

* The tarsi are 5-segmented.

* Cerci are absent.

* Most larvae are **campodeiform**, with mandibulate mouthparts.

* Most larvae are predaceous, but the larval Sisyridae feed on freshwater sponges, and the larval Mantispidae are parasitic in the egg sacs of spiders.

* Your text considers the Neuroptera as one big order. Other people divide these insects into 3 separate orders: 1) Megaloptera; 2) Raphidioptera; and 3) Planipennia. We will follow your text, but will consider the above three groups as suborders within the Neuroptera.

Taxonomy:

Suborder Megaloptera: 2 families.

* The best characters for separating the suborders is in the immature forms. The larvae of this suborder are aquatic (have abdominal gills). The mandibles and maxillae are undifferentiated and of the chewing type. The alimentary canal is complete. In fact, the larvae of this suborder are very similar to adepagous beetle larvae (very difficult to separate these larvae from those of the Gyrinidae and the Dytiscidae).

* These species pupate in earthen cells, and they are naked (not in cocoons). The pupae are **decticous**, that is, the mandibles (and other appendages) are moveable - can even defend themselves with the mandibles.

* The adults can be recognized by the shape of the wings. The hind wings are **broader at base** than are the forewings (reminiscent of Odonata wings). Probably the most diagnostic adult character is that the anal area of the hind wing is folded fan-like at rest.

* Longitudinal veins do not have branches near the wing margin (note: there may be a typo in the key as it says that the longitudinal veins usually do fork near wing margins).

* Ocelli may be present, or they may be lacking.

1. Sialidae: Alderflies (1 genus, *Sialis*, and about 24 North American species).

* Moderate sized (19-25mm in length), and usually dark in color.

* Usually with dusky or dark wings. Wings are held roof-like over the backs at a relatively sharp angle.

* Ocelli absent.

* Fourth tarsal segment dilated and deeply bilobed.

* Larvae are aquatic predators on small aquatic insects.

* The adult females lay eggs in masses on leaves, stems, etc. near the water. These eggs were probably first noticed associated with alder bushes (hence the common name). Each egg mass contains 200-900 eggs. Young larvae hatch and crawl into the water. *Sialis* larvae prefer muddy bottoms of ponds, lakes, and slow streams. Have been collected near Valley City.

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2. Corydalidae: Dobsonflies (larger) and Fishflies (smaller) (7 genera and 24 North American species)

- * Large in size, usually more than 25mm in length.
- * Wings transparent or with smoky areas. Wings are still roof-like over the backs, but at a much lesser angle than in the Sialidae (much flatter over the backs).
- * Ocelli present.
- * Fourth tarsal segment cylindrical.
- * Adult males of dobsonflies have long mandibles.
- * Larvae of dobsonflies (**hellgramites**) are excellent bass bait. Hellgramites have gills and paired anal hooks.
- * These larvae prefer moving water, and are often found on the bottom rocks. May take up to 5 years to complete life cycle.
- * Have been collected in the Buffalo River.
- * Some will come to lights.

Suborder Rhaphidioptera: snakeflies.

- * Some authors include these insects in with the Megaloptera.
- * The prothorax is elongate and snake-like (hence the common name). This prolongation is similar to that seen in the Mantispidae, but here the front legs are similar to the other legs (they are raptorial in the Mantispidae), and the front legs arise from the posterior end of the prothorax.
- * These insects can raise their head above their body giving the appearance of a snake about to strike.
- * The larvae and adults are predaceous, but the adults can catch only small and weak prey. The larvae have relatively small mandibles.
- * The pupae are naked (lacking cocoons), decticious.
- * There are 2 families, both are western in distribution (usually west of the Rocky Mountains).

1. Rhaphidiidae: raphidiid snakeflies (2 genera & about 20 North American species).

- * Prothorax elongate and snake-like.
- * Front legs not raptorial, but rather similar to the middle and hind legs, and arising near the posterior margin of the prothorax.
- * Larvae are often found on or under bark, feeding on soft immature insects.

Suborder Planipennia:

- * Adults lack ocelli.
- * Front and hind wings similar in size and shape.
- * Hind wings without enlarged anal area that is folded fanwise at rest.
- * Longitudinal veins with branches near wing margin.
- * The larvae are predators and have relatively long sickle-like mandibles (suctorial), and the food is sucked up through a channel formed between the mandible and maxilla. The larvae have a blindly ending midgut (also found in some Hymenoptera). The alimentary canal becomes complete during pupation; the larval fecal material is voided shortly after adult emergence.
- * Pupation occurs in a silken cocoon. The silk is produced by the Malpighian tubules and is spun from the anus.
- * These are all terrestrial families except the larvae of the Sisyridae.
- * Many authors include only these families in the Neuroptera.

Superfamily Hemerobioidea:

- * antennae filiform, moniliform, or pectinate, not clubbed or knobbed.

1. Mantispidae: mantidflies or mantispids (7 genera and 14 North American species).

- * very similar in appearance to preying mantids - compare - a good example of convergent evolution - 2 widely separated (taxonomically) groups have converged upon analogous body forms because of similar adaptations in behavior.

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- * prothorax is elongate (as in snakeflies), but front legs are raptorial and arise from the anterior end of the prothorax.
- * adults are predators; most larvae are parasites in spider egg cases; some larvae feed on immature wasps and bees.
- * have **hypermetamorphosis**; the 1st instar larvae are **campodeiform** (to enable mobility); later instars are **scarabaeiform**.
- * They do occur in North Dakota - a couple species in collection
- * Sometimes will come to lights
- * Some species are wasp mimics (mainly of vespids).
- * Life cycle: the eggs are laid on long **pedicels** as in the lace wings. They overwinter as eggs. In spring, campodeiform larva seek out egg cases of spiders (1 larva per spider egg case). Pupates in last larval skin. Female spiders (*Lycosa* sp. - wolf or ground spiders) look over their egg cases without showing hostility to the mantispid larvae.

2. Hemerobiidae: brown lacewings (6 genera and 61 North American species).

- * Resemble Chrysopidae but are brown in color instead of green and they are usually smaller than green lacewings.
- * Front wings with apparently 2-4 radial sectors. At least some costal cross veins forked. The wings are often somewhat hairy.
- * No pedicle for eggs.
- * Larvae feed on aphids and other small Homoptera.

3. Chrysopidae: common lacewings.

- * These are much more common than the brown lacewings.
- * Most species are greenish (but not all!).
- * Radial sector short and unbranched. Sc and R₁ not fused near wing tip. Costal veins simple. The wings are usually not hairy.
- * Larvae called aphid lions. They are often covered with debris.
- * Eggs are laid on stalks or pedicels to prevent cannibalism when they hatch.
- * In life chrysopids usually have bright golden colored eyes.
- * Very important predaceous family.
- * One species is a **Myrmecophile** (lives in ant nests).

4. Berothidae: beaded lacewings (1 genus and 10 North American species).

- * Rare but widely distributed.
- * Resemble a slender caddisfly with indented wings.
- * Called beaded lacewings probably because of the seed-like scales along the posterior margins of the veins of the females.
- * Specimen in vial - do not remove; not responsible for identification in tests.
- * The larvae prey on termites; they immobilize the prey by discharging a gas from the anus (an **allomone**) - this is unique in the insects.

5. Sisyridae: spongillafly (2 genera and 6 North American species).

- * see adults in alcohol vials - has been collected in North Dakota.
- * Larvae feed on freshwater sponges.
- * Sc and R₁ of front wing are fused at tip. Costal veins are not forked.
- * They resemble tiny brownish lacewings (3-7mm in length).

Superfamily Myrmeleontoidea:

- * Resemble dragonflies and damselflies in general appearance
- * Antennae clubbed or knobbed (clavate or capitate).

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1. Myrmeleontidae: antlions (13 genera and 92 North American species).

- * Antennae about as long as head and thorax together, and is usually more clavate in form.
- * Hypostigmatic or truss cell (one behind point of fusion of Sc and R₁, Fig. 27-4 A, hcl) several times as long as wide.
- * The common name, antlion, refers to the larvae of one tribe (Myrmeleontini) which constructs conical pits. They feed on ants or other small organisms that fall into the pits. They will flip sand up onto an organism that has fallen into the pit to aid in their falling clear to the bottom. They usually build their pits in sandy soil in a protected area such as under overhangs.
- * See illustration of unusual species that lives in the rock tombs of Egypt. They have the elongate heads to reach for prey between crevasses.
- * One interesting note: the gut of the larvae is incomplete, so no solid wastes are passed until the insect reaches the adult stage. Solid wastes are stored. The gut becomes complete during the pupal transformation, and then the solids are passed during the adult stage.

2. Ascalaphidae: owlflies (2 genera and 6 North American species).

- * Antennae nearly or quite as long as body, and is usually more capitate in form.
- * Hypostigmatic (truss) cell short, not more than 2 or 3 times as long as wide (Fig. 27-4 D, hcl)
- * Appear similar to the myrmeleontids but the antennae are much longer.
- * Larvae are also similar, but they don't build pits, they live on leaves.