

# Unit 11 - Neuropterida

Open Entomology Project

27 October 2016

## Introduction

Neuropterida is comprised of three orders—**Neuroptera** *sensu stricto*, **Megaloptera**, **Raphidioptera**—that are occasionally treated as one: Neuroptera *sensu lato* (that is, “in the broad sense”). The common ancestor of these insects is almost definitely a predator, as almost all (maybe all?) extant species eat other metazoans. There are several larval characters that support the monophyly of this lineage, the most interesting of which, perhaps, is the piercing-sucking, sickle-shaped mandibles with the maxillary groove and associated venom glands. These insects are less diverse (<7,000 extant species) than other holometabolans, although the fossil record suggests they were *much* more diverse in the past. The sister lineage to Neuropterida is likely the branch containing Coleoptera and Strepsiptera.

## Safety

We will be working with sharp tools and insects on pins. Wear your personal protective gear at all times. Specimens are to be returned to their vials after lab, and glycerine and ethanol will be collected for proper disposal or reuse.

## Methods

Working with a partner, organize your space, specimens, tools, and microscope. Use your probe and forceps to manipulate the specimen. In this lab, however, we will not be dissecting specimens (unless otherwise noted). You can start anywhere in the handout.

## Materials

- specimens (provided)
- fine forceps, probes (provided)
- sorting tray, watch glasses, gloves, safety glasses, glycerine, ethanol (provided)
- pencil/paper for sketches

## Bigger picture

This lineage is usually referred to as relictual. What does that mean? Why are these insects perhaps less diverse now than they were millions of years ago?

All known species are predators. Can you describe two or three adaptations for hunting, capturing, and otherwise subduing prey?

Familiarize yourself with the following taxon names, which refer to organisms you are likely to encounter in the northeastern USA and/or which are phylogenetically relevant. Can you describe how these arthropods live (natural history) and roughly how diverse they are? Do you know how they're related to one another? If you had to choose a family to study from the taxa below which one would it be and why?

1. Neuroptera
2. Megaloptera
3. Raphidioptera

## 1 Megaloptera

The larvae of all species develop in aquatic habitats; hind wings broader at base than fore wings; the hind wings with expanded anal lobes and extra anal veins.

### 1.1 Corydalidae (Dobsonflies, fishflies)

*Diagnostic characters:* Body usually large to very large (>25 mm); ocelli present; tarsomere 4 cylindrical; wings rarely completely dark.

*Natural history:* Larvae (hellgrammites) develop as generalist predators of aquatic insects, mainly in lotic habitats. Adults probably do not feed. Males usually have long, curved mandibles that are used in courtship and in fighting other males. Just over 200 species have been described worldwide.

### 1.2 Sialidae (alderflies)

*Diagnostic characters:* Body usually medium sized (<25 mm); ocelli absent; tarsomere 4 bilobed; wings usually entirely dark, almost black in color.

*Natural history:* Fewer than 100 species have been described worldwide, all of which are thought to be generalist predators of aquatic invertebrates in lotic environments.

**Question 11-1:** Megaloptera have many of the same key innovations as other Holometabola, including dicondylous mandibles, neopteran wings, and complete development. Why are there several orders of magnitude fewer species than, say, Coleoptera?



**Figure 1:** Corydalidae habitus. Photo (CC BY 2.0) by Andy Reago & Chrissy McClaren <https://flic.kr/p/odVAqf>



**Figure 2:** Sialidae habitus. Photo (CC BY-SA 3.0) by Fritz Geller-Grimm <https://goo.gl/F6h00a>

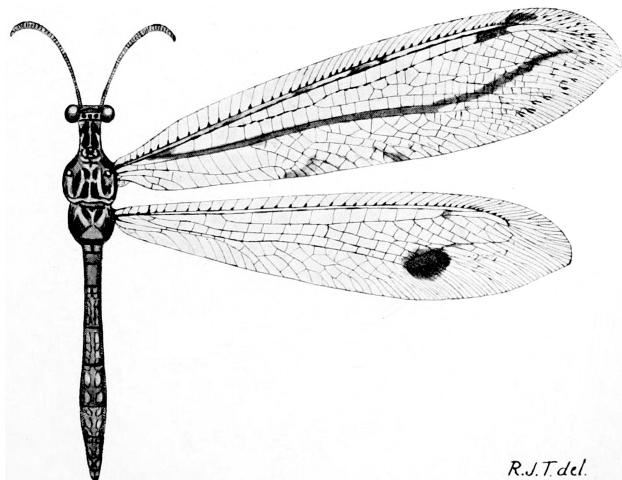
## 2 Neuroptera

Lacewings typically have complex wing venation and similarly shaped fore and hind wings, superficially similar to Odonata (with which they were classified a long time ago). Larvae of most species are terrestrial, and all known species develop as predators. More than 6,000 species have been described worldwide.

### 2.1 Myrmeleontidae (ant lions)

*Diagnostic characters:* Antenna as long as head + thorax; apical flagellomeres wider than proximal antennomeres; eyes never divided horizontally; thorax setose but not especially “fuzzy”.

*Natural history:* Larvae develop as ambush predators in terrestrial environments, with many species (but not all!) digging conical pits in loose substrates (e.g., fine-grained sand) to trap prey. Many adults likewise feed on other insects, although some are also known to eat pollen. Almost 2,000 species are known worldwide.



**Figure 3:** Myrmeleontidae habitus (Tillyard, 1916, Fig. III.8)

## 2.2 Ascalaphidae (owlflies)

*Diagnostic characters:* Antennae clubbed apically, as long as entire body; eyes often divided horizontally into two foveae; thorax often very “fuzzy”.

*Natural history:* More than 400 species have been described worldwide.



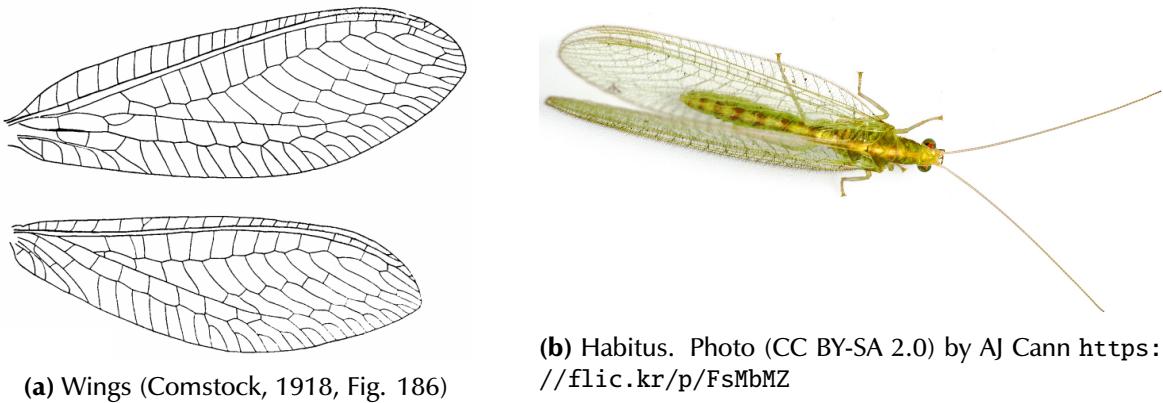
**Figure 4:** Ascalaphidae habitus. Photo (CC BY-NC 2.0) by Michael Jefferies <https://flic.kr/p/7kyLws>

## 2.3 Chrysopidae (green lacewings)

*Diagnostic characters:* Body color usually dominated by green and/or yellow shades but can be pink, brown, or other colors; antennae thread-like; crossveins along anterior edge of wing unbranched; wing cells tend to be short, boxy (Figure 5a).

*Natural history:* Larvae emerge from stalked eggs and develop as predators of other insects, especially aphids and other soft-bodied insects. Larvae are often referred to as “aphid wolves” due to their

propensity to cover their bodies in aphid carcasses to avoid detection by prey. Adults consume honeydew and/or other insects as adults. There are at least 1,300 described species worldwide.

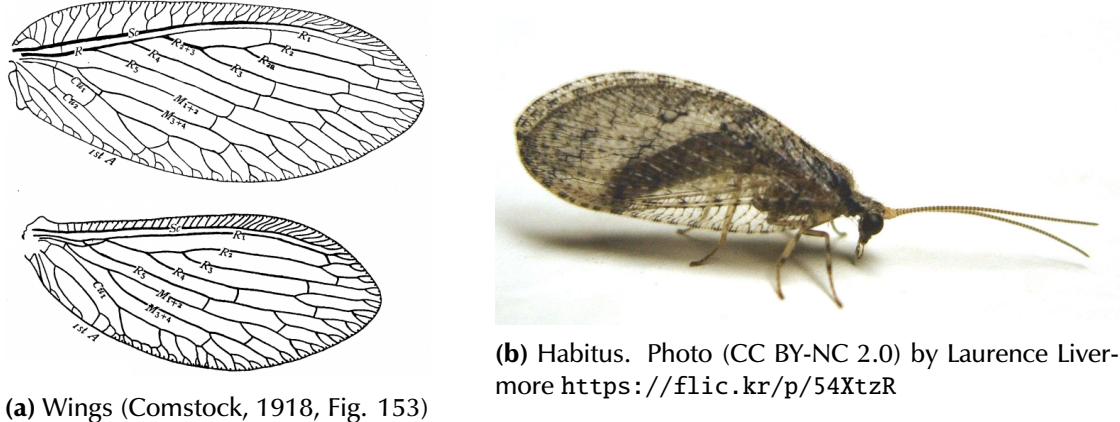


**Figure 5:** Chrysopidae

## 2.4 Hemerobiidae (brown lacewings)

*Diagnostic characters:* Body color almost always mottled brown; antennae thread-like; crossveins along anterior edge of wing branched; wing cells tend to be rectangular/elongate (relative to Chrysopidae).

*Natural history:* Although they are not sister lineages, the natural history of Hemerobiidae is very similar to Chrysopidae; larvae and adults are predators of other insects, especially aphids. There are >600 species worldwide.



**Figure 6:** Hemerobiidae

**Question 11-2:** Based on the eye morphology and feeding habits of the preceding four families (2.1–2.4) what would you hypothesize about the natural history of Ascalaphidae?

## 2.5 Mantispidae (mantidflies)

*Diagnostic characters:* Antennae relatively short, thread-like; prothorax elongate; fore legs raptorial, arising far anterior on prothorax.

*Natural history:* Larvae often have complex natural histories, e.g., developing as ambush predators in terrestrial habitats, as parasitoids on some Coleoptera and Hymenoptera, or as predators within spider egg sacs. Adults use raptorial fore legs to catch prey, and many species mimic stinging Hymenoptera.

**Question 11-3:** How are these insects different than mantids? How are they the same?



**Figure 7:** Mantispidae habitus. Photo (CC BY-NC 2.0) by Ian McMillan <https://flic.kr/p/p4jErn>

## 2.6 Coniopterygidae (dustywings)

*Diagnostic characters:* Body much smaller (usually <7 mm) than most other neuropterans and covered in white waxy substance; wings with fewer veins than other neuropterans (e.g., R branches only twice; Figure 8a).

*Natural history:* Larvae live on woody plants, where they eat small, soft-bodied prey – including white-flies (Aleyrodidae) and mealybugs (Pseudococcidae), to which dustywings have more than a passing resemblance. There are almost 500 species known worldwide.

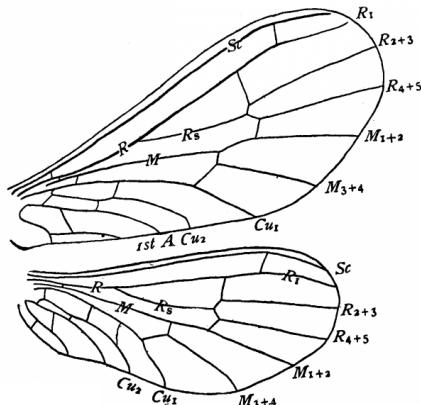
**Question 11-4:** Why are these insects typically covered in a waxy powder? What are the possible functions of this substance, which can be found on larvae and adults. Hint: You've seen this phenotype before!

# 3 Raphidioptera (snakeflies)

The prothorax elongate but legs arise posteriorly on prothorax. In North America, these insects are found only out west.

## 3.1 Raphidiidae

*Diagnostic characters:* Female with long ovipositor; ocelli present; crossvein present inside stigma.



(a) Wings (Comstock, 1918, Fig. 211)



(b) Habitus. Photo (CC BY 2.0) by Mick Talbot <https://flic.kr/p/6gXSSD>

**Figure 8:** Coniopterygidae

*Natural history:* All stages are predaceous, and one can usually find these insects near or on trees.



**Figure 9:** Raphidiidae. Photo (CC BY-SA 2.0) by Marshal Hedin <https://flic.kr/p/854RgB>

## Epilogue

This handout is part of an open curriculum. Original files are available free for anyone to download, copy, modify, and improve at the Open Entomology GitHub repository (Open Entomology Project, 2016), which also provides a mechanism for reporting problems and other feedback:  
<https://github.com/OpenEntomology/InsectBiodiversityEvolution/issues>

## Acknowledgments

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## References

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