

## **Guide to Insect and Non-Insect Arthropods**

### **I. Insect Orders**

#### **Phylum Arthropoda, Subphylum Hexapoda, Class Insecta**

##### **Insect Characteristics**

Most adult insects have:

- A body divided into three regions (head, thorax and abdomen)
- Three pairs of legs
- Usually one pair of antennae and a pair of compound eyes (a few exceptions to these characteristics are found)
- Usually two pairs of wings (wings are absent in insects such as lice, fleas, [some] ants; flies and other Diptera have one pair of wings)

The Class Insecta is generally divided into about 30 orders. Many of these orders are of minor importance and are studied only because of scientific interest. Considered here are some of the most important or common orders likely to be encountered. Many taxonomists (scientists who classify and name organisms) disagree on the number of orders and their names. Thus, this scheme will often vary.

Insect orders are groups of insects with a common descent that are similar in body structure, type of wings, type of mouthparts, etc., and to some extent, in habits. With approximately 1,000,000 different insect species, it is impossible to become familiar with more than a small percentage of them. A fundamental step in insect identification is recognition of order. One should be able to assign nearly all insects to order with a little study. This placing allows a person to conclude many things about the insect from known information about the order.

Each insect order shares a set of characteristic biological and anatomical features. Therefore, proper interpretation of mouthparts, wings, etc., aids in recognition of orders. A good entomologist can recognize common insect orders quickly. In more advanced entomology, the ability to assign an insect to a family, genus and species becomes necessary. As the insect is assigned to a more precise group, it corresponds more closely to other individuals in that group. Thus, classification helps us become familiar with, and organize, our knowledge concerning insects. Classification also allows one to use the proper scientific name to correctly look up information about a species.

Table 1. 4-H Level and List of Required **Insect** Orders. Older groups of learners are responsible for all material presented to younger groups. Color bars are repeated on the descriptions of insect orders.

| Junior<br> | Intermediate<br> | Senior<br> |
|---|---|---|
| Thysanura   | Thysanura   | Archaeognatha   |
| Odonata   | Ephemeroptera   | Thysanura   |
| Blattodea   | Odonata   | Ephemeroptera   |
| Mantodea  | Plecoptera  | Odonata   |
| Orthoptera  | Blattodea   | Plecoptera  |
| Phasmatodea   | Mantodea  | Blattodea   |
| Phthiraptera  | Dermaptera  | Mantodea  |
| Hemiptera   | Orthoptera  | Dermaptera  |
| Neuroptera  | Phasmatodea   | Orthoptera  |
| Coleoptera  | Psocoptera  | Phasmatodea   |
| Diptera   | Phthiraptera  | Psocoptera  |
| Lepidoptera   | Hemiptera   | Phthiraptera  |
| Hymenoptera   | Thysanoptera  | Hemiptera   |
|   | Neuroptera  | Thysanoptera  |
|   | Coleoptera  | Neuroptera  |
|   | Mecoptera   | Coleoptera  |
|   | Siphonaptera  | Mecoptera   |
|   | Diptera   | Siphonaptera  |
|   | Lepidoptera   | Diptera   |
|   | Hymenoptera   | Trichoptera   |
|   |   | Lepidoptera   |
|   |   | Hymenoptera   |

Table 2. 4-H Level and List of Required **Non-Insect** Orders. Older groups of learners are responsible for all material presented to younger groups. Color bars are repeated on the descriptions of insect orders.

| Junior<br> | Intermediate<br> | Senior<br> |
|---|---|---|
| Acari   | Acari   | Acari   |
| Aranae  | Aranae  | Aranae  |
| Scorpiones  | Scorpiones  | Scorpiones  |
|   | Solifugae   | Solifugae   |
|   | Collembola  | Opiliones   |
|   | Opiliones   | Collembola  |
|   |   | Thelyphonida  |
|   |   | Isopoda   |
|   |   | Class Dipopoda  |
|   |   | Class Chilopoda   |

## Quick Summary of Insect and Non-insect Orders

Table 3. Insect Orders required for 4-H Senior Level.

|   |   |
|---|---|
| <b>----- Subclass Apterygota: Primitive wingless insects -----</b>  |   |
| These insects are wingless and have no metamorphosis (are ametabolous), juveniles resemble adults except for size and sexual maturity, molting continues until death.   |   |
| Archaeognatha   | Bristletails  |
| Thysanura   | Silverfish, Firebrats   |
| <b>----- Subclass Pterygota: The winged insects -----</b>   |   |
| <b>Infraclass Paleoptera: These are relatively primitive insects that have hemimetabolous development but cannot fold their wings back over the abdomen horizontally.</b>   |   |
| Ephemeroptera   | Mayflies  |
| Odonata   | Damselflies and Dragonflies   |
| <b>Infraclass Neoptera: All of these insects can fold their wings over their backs horizontally when at rest. The group is divided into those with hemimetabolous or holometabolous development.</b>              |   |
| <b>Superorder Exopterygota: (Hemimetabola)</b> juveniles are called nymphs, wings develop externally, metamorphosis is incomplete (or simple) and the life stages are egg, nymph, adult. There is no pupal stage. |   |
| Plecoptera  | Stoneflies  |
| Blattodea   | Cockroaches, Termites   |
| Mantodea  | Mantids   |
| Dermaptera  | Earwigs   |
| Orthoptera  | Short-horned Grasshoppers, Long-horned Grasshoppers, Katydid, and Crickets  |
| Phasmatodea   | Walkingsticks, Leaf insects   |
| Psocoptera  | Barklice, Booklice  |
| Phthiraptera  | Lice  |
| Hemiptera   | Suborder Heteroptera (True Bugs)<br>Suborder Auchenorrhyncha (Cicadas, Hoppers)<br>Suborder Sternorrhyncha (Aphids, Psyllids, Whiteflies, Scales) |
| Thysanoptera  | Thrips  |
| <i>This is the end of the Exopterygota. Infraclass Neoptera continues on the next page with the Endopterygota.</i>  |   |

**Superorder Endopterygota (Holometabola):** immatures are called larvae, wings develop internally, metamorphosis is holometabolous (complete), life stages are egg, larva, pupa, adult.

|              |  |
|--------------|--|
| Neuroptera   | Dobsonflies, Lacewings, Antlions, Owlflies, Mantispids |
| Coleoptera   | Beetles  |
| Mecoptera    | Scorpionflies  |
| Siphonaptera | Fleas  |
| Diptera      | Flies  |
| Trichoptera  | Caddisflies  |
| Lepidoptera  | Butterflies, Moths, Skippers                           |
| Hymenoptera  | Wasps, Bees, Ants, Sawflies, Horntails                 |

Table 5. Non-insect arthropods.

## Classification of the Non-Insects

### PHYLUM ARTHROPODA, SUBPHYLUM CHELICERATA, CLASS ARACHNIDA

|                    |                             |
|--------------------|-----------------------------|
| Order Acari        | Ticks, mites, chiggers      |
| Order Araneae      | Spiders                     |
| Order Opiliones    | Harvestmen                  |
| Order Scorpiones   | Scorpions                   |
| Order Solifugae    | Sunspiders or camel spiders |
| Order Thelyphonida | Vinegaroons                 |

### PHYLUM ARTHROPODA, SUBPHYLUM MYRIAPODA

|                 |            |
|-----------------|------------|
| Class Diplopoda | Millipedes |
| Class Chilopoda | Centipedes |

### PHYLUM ARTHROPODA, SUBPHYLUM HEXAPODA, CLASS ENTOGNATHA

|                  |             |
|------------------|-------------|
| Order Collembola | Springtails |
|------------------|-------------|

### PHYLUM ARTHROPODA, SUBPHYLUM CRUSTACEA, CLASS MALACOSTRACA

|               |                   |
|---------------|-------------------|
| Order Isopoda | Sowbugs, Pillbugs |
|---------------|-------------------|

Table 4. Insect Order and type of metamorphosis, also the type of mouthparts in adult and juvenile stages. Mandibulate mouthparts mean there are mandibles (teeth) present, and these are used for chewing. There are various forms of haustellate mouthparts, but they are all essentially used for piercing-sucking or sucking.

| <b>Insect Order</b> | <b>Common Name</b>                 | <b>Metamorphosis<br/>(name of juvenile stage)</b>     | <b>Adult Mouthparts</b>               | <b>Juvenile Mouthparts</b>            |
|---------------------|------------------------------------|---|---------------------------------------|---------------------------------------|
| Archaeognatha       | Bristletails                       | ametabolous   | mandibulate                           | mandibulate                           |
| Thysanura           | Silverfish,<br>Firebrats           | ametabolous   | mandibulate                           | mandibulate                           |
| Ephemeroptera       | Mayflies                           | hemimetabolous<br>(juveniles called naiads or nymphs) | mandibulate<br>(adults do not feed)   | mandibulate                           |
| Odonata             | Damselflies,<br>Dragonflies        | hemimetabolous<br>(naiads or nymphs)                  | mandibulate                           | mandibulate                           |
| Plecoptera          | Stoneflies                         | hemimetabolous<br>(naiads or nymphs)                  | mandibulate                           | mandibulate                           |
| Orthoptera          | Grasshoppers,<br>Katydid, Crickets | hemimetabolous<br>(nymphs)                            | mandibulate                           | mandibulate                           |
| Phasmatodea         | Walking sticks,<br>Leaf insects    | hemimetabolous<br>(nymphs)                            | mandibulate                           | mandibulate                           |
| Dermaptera          | Earwigs                            | hemimetabolous<br>(nymphs)                            | mandibulate                           | mandibulate                           |
| Mantodea            | Mantids                            | hemimetabolous<br>(nymphs)                            | mandibulate                           | mandibulate                           |
| Blattodea           | Cockroaches,<br>termites           | hemimetabolous<br>(nymphs)                            | mandibulate                           | mandibulate                           |
| Psocoptera          | Barklice, Booklice                 | hemimetabolous<br>(nymphs)                            | mandibulate                           | mandibulate                           |
| Phthiraptera        | Lice                               | hemimetabolous<br>(nymphs)                            | Some mandibulate,<br>some haustellate | Some mandibulate,<br>some haustellate |
| Thysanoptera        | Thrips                             | hemimetabolous<br>(nymphs)                            | haustellate<br>asymmetrical           | haustellate<br>asymmetrical           |

Hemiptera      True Bugs,      hemimetabolous      haustellate      haustellate

Cicadas, Hoppers, (nymphs)  
Aphids, Psyllids,  
Whiteflies, Scales

*continues on next page*

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| <b>Insect Order</b> | <b>Common Name</b>                               | <b>Metamorphosis</b>       | <b>Adult Mouthparts</b>  | <b>Juvenile Mouthparts</b> |
|---------------------|--|----------------------------|--|----------------------------|
| Neuroptera          | Dobsonflies,<br>Lacewings,<br>Antlions, Owlflies | holometabolous<br>(larvae) | mandibulate (dobsonflies do not feed)                                      | mandibulate                |
| Mecoptera           | Scorpionflies                                    | holometabolous<br>(larvae) | mandibulate  | mandibulate                |
| Siphonaptera        | Fleas  | holometabolous<br>(larvae) | haustellate  | mandibulate                |
| Coleoptera          | Beetles  | holometabolous<br>(larvae) | mandibulate  | mandibulate                |
| Diptera             | Flies  | holometabolous<br>(larvae) | haustellate<br>(modified for<br>biting/sucking or<br>licking/<br>sponging) | mandibulate                |
| Trichoptera         | Caddisflies                                      | holometabolous<br>(larvae) | mandibulate<br>(many adults do<br>not feed)                                | mandibulate                |
| Lepidoptera         | Butterflies, Moths,<br>Skippers                  | holometabolous<br>(larvae) | haustellate<br>(one primitive<br>suborder is<br>mandibulate)               | mandibulate                |
| Hymenoptera         | Wasps, Bees,<br>Ants, Sawflies                   | holometabolous<br>(larvae) | mandibulate<br>(but haustellate<br>in Bee<br>suborder)                     | mandibulate                |



# Common Insect Orders *(Click on an order name to hear it pronounced)*

This page presents Subclass **Apterygota**, primitively wingless insects

## Archaeognatha



(bristletails)



photo credit:Whitney Cranshaw

Name Derivation:  
Greek, "ancient jaw"

Metamorphosis: ametabolous

Mouthparts: chewing

Biology: Most species are found in moist soil, but some can be found in drier climates. Their food consists mainly of decaying organic matter, mosses, lichens or algae.

Key Characteristics: Mandibles are primitive in that they have only one point of articulation with the head. All other insects have two. They have compound eyes that meet at the top of the head, and this character can be used to separate them from Thysanura which have large eyes that don't meet at the top of the head.

Archaeognatha can jump as far as 12 inches into the air by using their tail.

## Thysanura



(silverfish and firebrats)



Name Derivation:  
Latin, "fringe-tail"

Metamorphosis: ametabolous

Mouthparts: chewing

Biology: Silverfish and firebrats are usually found in moist locations around houses or under stones and boards outdoors. They run rapidly and hide in cracks and crevices. They are secretive and usually are most active at night. Silverfish can be a nuisance in houses. Occasionally they damage book bindings, curtains, wallpaper etc.

Key Characteristics: Thysanura are wingless with long antennae and three thread-like filaments at the tip of the abdomen.

## This page presents the Paleoptera, relatively primitive insects

### Ephemeroptera



(mayflies)



Name Derivation:

Latin, "day" or "short-lived" (ephemero); "wings" (ptera)

Metamorphosis: hemimetabolous

Mouthparts: chewing (vestigial), adults do not feed

Biology: Aquatic nymphs live in water and have chewing mouthparts. Adults are common around water, especially in spring, when they often emerge in large numbers. They are an important fish food. Fish eat both the nymphs and adults. Adult mayflies live only for one or two days. They do not feed during their adult life; their purpose is to mate and lay eggs for future generations of mayflies. Mayflies molt once after they have developed wings. Mayflies are the only insect group that molts after the wings are fully developed.

Key Characteristics: Ephemeroptera are delicate insects with two pairs (rarely just one pair) of triangular shaped wings with many veins; the front pair is large and the hind pair is small. They have long front legs and two or three long, tail-like appendages. The adults have reduced mouthparts and do not feed.

### Odonata



(dragonflies and damselflies)



Name Derivation: Greek word meaning "tooth"

Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Young live in water and are not like the adults. Adults are common around ponds, lakes and streams. Both adults and aquatic nymphs feed on insects. They are beneficial, because they feed to some extent on mosquitoes and other small flies. Dragonflies and damselflies can hover like a helicopter or fly and dart around rapidly. They have been called "mosquito hawks" and "snake doctors."

Key Characteristics: Odonata are large insects with two pairs of membranous, many-veined wings; the hind pair is as large as or larger than the front pair. They have large conspicuous eyes and bristle-like antennae.

## Here begins the Exopterygota (Hemimetabola) -----

### Plecoptera



(stoneflies)



Name Derivation: Latin, “folded” (pleco); “wings” (ptera)

Metamorphosis: hemimetabolous

Mouthparts: chewing, many adults do not feed

Biology: Aquatic nymphs live under stones in rapidly running streams. Adults are found on stones or plants near streams and are attracted to lights. These soft-bodied insects are difficult to find. They are sometimes abundant in early spring near a stream.

Key Characteristics: Plecoptera are large, soft-bodied insects that are from 1/2 inch to 2 inches long. They have four wings that fold flat over the back; the hind wings fold like a fan and are much larger than the front wings. Antennae are long, and there are two long, tail-like appendages at the tip of the abdomen.

### Blattodea



(cockroaches and termites)



Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Cockroaches are somewhat general feeders, but prefer materials high in fats and starches. They deposit their eggs in a capsule called an ootheca. Several species invade homes where they can contaminate food and spread disease. They have an unpleasant odor and can be very annoying.

Termite swarmers leave the colonies to mate and search for new nesting sites. Termites are important to humans because they do millions of dollars in damage to houses each year. They feed on wood and digest it with the help of microbes in their digestive systems or enzymes the termites produce themselves. Termites are also important decomposers of wood in the ecosystem.



Name Derivation: Greek work meaning “shuns light”

Key Characteristics: Cockroaches are cursorial (adapted for running) and move rapidly. They have flattened bodies and a head concealed from above by the pronotum. They have two pairs of wings, but in some species the wings are greatly reduced.

Termites have bead-like antennae, wings absent or present, and membranous wings similar in size, shape, and pattern when present. Workers are small, soft-bodied, yellowish or whitish insects that live in colonies in wood.

Colonies consist of three castes: workers, soldiers and swarmers. Workers and soldiers are wingless and never leave the colony. Swarmers, or the reproductive forms, have dark bodies and four long, many-veined wings.

## Mantodea



(mantids or praying mantids)



Name Derivation: Greek word meaning “soothsayer”

Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Mantids are predaceous on a large variety of insects. They usually wait motionless for their prey to venture within striking distance. Mantids are well known as biological control agents. However, they do not distinguish between useful and destructive species, but feed on any prey that come near.

Key Characteristics: Mantodea are large, elongate and slow-moving insects. Their front legs are greatly modified for grasping prey.

## Dermaptera



(earwigs)



Name Derivation: Latin, “skin” (derma); “wings” (ptera)

Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Earwigs are usually found hiding under leaves, boards or in cracks outdoors during the day. Earwigs can be destructive in greenhouses. They release a bad-smelling substance when disturbed.

Key Characteristics: Dermaptera are medium-sized insects usually with four wings. The front pair is short, leaving the abdomen exposed. The hind wings are folded under the front wings. A pair of non-venomous pinchers is found at the end of the abdomen.

## Orthoptera



(grasshoppers, crickets and katydids)



Name Derivation: Latin, “straight” (ortho); “wings” (ptera)

Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Nymphs resemble adults. Adults in several groups in this order never develop wings. These include such odd insects as the cave crickets. The order Orthoptera is a large one. Some members of this group are quite destructive to crops (grasshoppers).

Key Characteristics: Orthoptera have long antennae and various leg modifications. They generally have two pairs of wings with many veins. The front pair is usually slender and the hind pair is broad and fan-like. Wings are reduced to small pads in some adult grasshoppers and crickets.

## Phasmatodea



(walking sticks and leaf insects)



Name Derivation: Latin word meaning “phantom”

Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Walkingsticks are slow moving and are generally found on trees or shrubs. Walkingsticks may be able to regenerate lost legs. These insects have chewing mouthparts and feed on foliage. Our species are wingless as adults. However, some tropical forms are winged and are called leaf insects.

## Psocoptera



(barklice, booklice)



Name Derivation: Latin, “gnawed” (psoco); “wings” (ptera) (This refers to the gnawing habits of these insects.)

Metamorphosis: hemimetabolous

Mouthparts: chewing

Biology: Booklice are found around old books and in damp, dark rooms. Most live out-of-doors and are found resting in soil litter, around vegetation or on stones, logs and fences. They are rather uncommon but may be locally abundant. Some booklice feed on stored grains while others are library pests. They are microscopic to 1/4 inch in size.

Key Characteristics: Psocoptera are tiny insects that have either four wings or none at all. They are small and soft-bodied with long, thin antennae.

Key Characteristics: Phasmatodea species have elongate bodies.

# Phthiraptera



(lice)



Name Derivation: Phthiraptera =  
“lice” (phthir); “without” (a);  
“wings” (ptera)  
Mallophaga: Latin, “wool” (mallo);  
“eat” (phaga)  
Anoplura: Latin,  
“unarmed” (anopl); “tail” (ura)

Metamorphosis: hemimetabolous

Mouthparts: some chewing, some sucking;  
depends on suborder

Biology: Phthiraptera are divided into two suborders: Mallophaga (or chewing lice) and Anoplura (or sucking lice). Chewing lice feed on bits of hair, feathers or skin of the host. Lice deposit their eggs on the hair or feathers of the host. They are important pests of domestic birds and animals, but they do not live on humans. Sucking lice feed mainly on blood. These insects are found commonly on mammals (including humans), but not on birds. They feed by sucking blood and are important pests of domestic animals and humans. Eggs are laid on individual hairs and are commonly called “nits”. The human body louse has been responsible for millions of human deaths through the centuries because it spreads the organism causing epidemic typhus.

Key Characteristics: Phthiraptera are wingless parasites that live on most birds and mammals. They are small, flat, and wingless with short legs and short antennae. They are about 1/6 to 3/16 inch long when mature.

# Hemiptera



(true bugs, cicadas, hoppers, aphids, psyllids, whiteflies, scales)



Suborder Auchenorrhyncha



Suborder Heteroptera



Aphids, Suborder Sternorrhyncha

Metamorphosis: hemimetabolous

Mouthparts: piercing-sucking

Biology: Hemiptera are found on plants and animals, or in water. Some of them cause considerable plant damage by their feeding. Some are beneficial because they prey on other insects.

Key Characteristics: Suborder Heteroptera are the true bugs and have a beak arising from front of the head, long antennae, and two pairs of wings (in most adults). Members of this suborder usually have four wings held flat over the body. The front of wings is thickened and leathery at the base with membranous tips or ends and they are called hemelytra. Members of the suborders Auchenorrhyncha and Sternorrhyncha have a beak that arises more toward the base of the head. The Auchenorrhyncha include cicadas, spittlebugs, leafhoppers, treehoppers and planthoppers. The Sternorrhyncha include psyllids, aphids, whiteflies and scales.



Suborder Heteroptera

Name Derivation: Latin, "half" (hemi); "wings" (ptera)



# Thysanoptera



(thrips)



Name Derivation: Latin, "fringe" (thysano); "wing"(ptera)

Metamorphosis: hemimetabolous

Mouthparts: piercing-sucking

Biology: Surfaces are rasped by the mouthparts and the juices sucked up. Immature stages resemble the adults. Some of the insects feed on plants, others prey on small arthropods and/or their eggs. Those that feed on plants are frequently injurious in greenhouses or on vegetable crops or cotton. They will also bite humans but only cause momentary discomfort.

Key Characteristics: Thysanoptera are wingless or winged. Wings are narrow, strap-like and deeply fringed wings. They are tiny insects about 1/8-inch long.

-----Here begins the Endopterygota (Hologmetabola)-----

## Neuroptera



[Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.]

(mantidflies, lacewings, antlions, owlflies)



Name Derivation: Latin, "nerve" or net referring to the many wing veins (neuro); "wings" (ptera)

Metamorphosis: holometabolous

Mouthparts: chewing

Biology: Immature stages are predaceous, dobsonfly larvae are aquatic. Lacewings and their immature forms, known as aphid lions, are the most common insects in this order, and both adults and larvae feed on aphids. Adult green lacewings can be found throughout the year. They are considered beneficial because they feed on other insects. Immature ant lions are called "doodlebugs", and they form pits in dry, dusty soil. Dobsonflies are also in the order Neuroptera and considered beneficial. Dobsonfly larvae, called hellgrammites, are frequently used as fish bait.

Key Characteristics: Neuroptera have two pairs of similar-sized membranous wings with a complex, net-like pattern of venation. They are rather fragile insects. Chewing mouthparts occur in adults, but some larval mouthparts are modified for piercing and sucking.

## Coleoptera



(beetles and weevils)



Name Derivation: Latin, “sheath” (coleo); “wings” (ptera)

Metamorphosis: holometabolous

Mouthparts: chewing

Biology: Immature stages are grub-like or worm-like and the insects pass through a pupal stage before becoming adults. Food habits are varied. Some feed on living plants; some are predaceous; some are scavengers; and some bore in wood. This order includes some of the best-known and most important insect pests. Most of the members are terrestrial, but some are aquatic. Coleoptera is the largest order, including about 1/4 of all known insects (about 280,000 different species). Perhaps the most famous members of this group are lady beetles and the cotton boll weevil.

## Mecoptera



(scorpionflies)



Name Derivation: Latin, “long” (meco); “wings” (ptera)

Metamorphosis: holometabolous

Mouthparts: chewing

Biology: Scorpionflies do not sting and are harmless. The structure that seems to be a stinger is actually an abdominal enlargement on the males. Scorpionflies are usually found only during a two- or three-week period in the summer. These insects are found resting on plants that grow along the banks of streams and in damp woods. The larvae are like caterpillars and live in damp soil. Adults feed on dead and dying insects, rotting fruit and nectar. The adults sometimes are attracted to lights. Scorpionflies are seldom common.

Key Characteristics: Mecoptera are small to medium-sized insects with four long, narrow wings and long antennae. They have chewing mouthparts located at the end of a broad, flat snout which is two or three times as long as the head is wide.

Key Characteristics: Coleoptera have the front pair of wings (elytra) hard and shield-like, meeting in a straight line down the middle of the back. They usually have two pairs of wings. The hind wings are membranous and are folded under the front wings when at rest.

## Siphonaptera



(fleas)



Name Derivation: Latin,  
“tube” (siphon);  
“wingless” (aptera)

Metamorphosis: holometabolous

Mouthparts: piercing-sucking

Biology: Fleas are well known as pests of domestic animals and humans. One species transmits the bacterium that causes plague. Plague has killed more than 125 million people during the past 3,000 years. These insects suck blood only as adults, and females must have a blood meal before they can reproduce. They usually feed on animals but will attack humans. Larvae feed on organic matter and blood excreted by adults and are often found in nests of various animals.

Key Characteristics: Siphonaptera are small, wingless, flattened from side to side (laterally), and have jumping hind legs. Spines on the body point to the rear of the insect which allows them to move through the hair of an animal easily. The immature or larval stage is worm-like, quite different from the adults.

# Diptera



(flies, midges, gnats, mosquitoes)



Name Derivation: Latin, “two” (di); “wings” (ptera)

Metamorphosis: holometabolous

Mouthparts: haustellate in adults (modified for biting/sucking or licking/sponging) or mandibulate

Biology: Diptera is a very important order. It includes forms that are parasitic, predaceous, and other forms that live on either living or dead plant or animal material. Some Diptera cause significant damage to crops, while others can act as pollinators. Many harmful flies, such as mosquitoes, spread diseases (such as yellow fever, West Nile virus, and malaria) and are responsible for millions of human deaths. Because many of the species carry diseases, this is one of the most important orders from the standpoint of human health.

Key Characteristics: Diptera are usually winged, but have only one pair of wings with few veins. Hind wings are represented by a pair of slender, knobbed structures called halteres that are reduced in size and sensory in function. Mouthparts are formed for sucking or piercing and sucking. Fly larvae are known usually as maggots; they are entirely unlike the adults. Flies occur in many shapes and sizes.

## Trichoptera



(caddisflies)



Name Derivation: Latin, “hairy” (tricho); “wings” (ptera)

Metamorphosis: holometabolous

Mouthparts: chewing, adults do not feed

Biology: Adults are common around streams. Adults do not feed and have reduced, non-functional mouthparts. Larvae live in water and most build cases to enclose their bodies. Larvae are scavengers, herbivores or predators with chewing mouthparts, and their presence or absence can be an indicator of water quality.

Key Characteristics: Trichoptera have long antennae, four hairy wings (folded tent-like over their body) and resemble small, dull-colored moths. They are soft-bodied insects as adults and larvae. Larvae resemble caterpillars with few hairs.

## Lepidoptera



(butterflies, moths, skippers)



Name Derivation: Latin, “scale” (lepid); “wings” (ptera)

Metamorphosis: holometabolous

Mouthparts: primitively chewing, but structures in adults usually developed into a tube (proboscis) for lapping or sucking. Larvae have chewing mouthparts.

Biology: This is one of the best-known orders of insects and contains some of our most important pests, such as the codling moth, armyworm, clothes moth, and cabbageworm. Most of the caterpillars feed on leaves of plants, while others bore into plant stems or fruit and still others are leafminers or stored product pests.

Key Characteristics: Lepidoptera usually have four well-developed wings covered with overlapping scales. Mouthparts of the adults are formed for sucking. Immature stages (larvae) are worm-like. Some are known as caterpillars, cutworms or hornworms; and their mouthparts are formed for chewing.

# Hymenoptera

(bees, ants, wasps, sawflies, horntails)



Metamorphosis: holometabolous

Mouthparts: chewing



Name Derivation:  
Latin, "membrane"  
(hymeno); "wings"  
(ptera)

Biology: Habits of these insects are varied: some are predaceous, some are parasitic, some cause plant galls, and some feed on plant foliage. Others, such as bumble bees and honey bees eat plant pollen and nectar. This order includes some of our most harmful, as well as some of our most beneficial insects. The abdomen in the females is usually furnished with a stinger. Many of these insects have a painful sting and should be avoided if possible.

Key Characteristics: Hymenoptera have membranous wings with few veins and the frontwings larger than the hindwings. Some individuals are wingless. Mouthparts are formed for chewing or for both chewing and sucking. The body is usually constricted greatly between the abdomen and thorax. Immature stages are maggot-like or caterpillar-like and are entirely different from the adults.

## The Phylum Arthropoda (Non-Insect Arthropods)

Arthropods are invertebrates that have an exoskeleton (external skeleton), a segmented body and jointed appendages. The name of the Phylum derives from the Greek antron (joint) and podos (foot). It has been estimated that more than 80% of the species on earth are Arthropods. The following table lists living Subphyla, Classes and Orders of arthropods that are covered in this 4-H unit on insects. Table items in bold text may be included in exams.

### Phylum Arthropoda

#### Subphylum Chelicerata (Arachnida and others)

##### Class Arachnida

**Order Acari (or Acari) (ticks, mites, chiggers) Order**

**Araneae (spiders)**

**Order Opiliones (harvestmen)**

**Order Scorpiones (scorpions)**

**Order Solifugae (sunspiders or camel spiders)**

**Order Thelyphonida (formerly Uropygida) (vinegaroons)**

#### Subphylum Myriapoda

**Class Chilopoda (Centipedes)**

**Class Diplopoda (Millipedes)**

#### Subphylum Hexapoda

**Class Insecta (Insects)**

**Class Entognatha**

**Order Collembola**

Order Protura

Order Diplura

#### Subphylum Crustacea (Crustaceans): a partial list:

Class Branchiopoda (brine shrimp and others)

Class Maxillopoda (barnacles and copepods)

**Class Malacostraca**

**Order Isopoda (pillbugs, sowbugs)**

Order Decapoda (crayfish, crabs, lobsters, shrimp)

Characteristics of Class Arachnida are:

1. A body divided into two regions (cephalothorax and abdomen)
2. Adults have four pairs of legs
3. No antennae
4. No wings



# Subphylum Chelicerata, Class Arachnida

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## Order Acari ■

(ticks, mites, chiggers)



Metamorphosis: none

Mouthparts: piercing-sucking

Biology: There are usually four stages; egg, larva, nymph and adult. (The terms larva and nymph are not used the same here as for insects.) No metamorphosis is present because adults resemble young and no wings are present. Ticks only feed on blood of animals. Ticks are responsible for spreading disease organisms such as the organism that causes Rocky Mountain spotted fever in man and cattle fever in cattle.

Key Characteristics: Ticks and mites are wingless, lack antennae and usually have flat or round bodies. Adults have eight legs, although some immature stages have only six legs. Many are microscopic.

## Order Araneae ■

(spiders)



Metamorphosis: simple

Mouthparts: pair of chelicerae

Biology: Mouthparts are a pair of chelicerae, each with a piercing tooth. Chelicerae are used to manipulate captured prey but all food intake is liquid. Palpi are used much like antennae in insects and in males are used during mating. Most spin webs of various sorts to capture prey or as a refuge. All spiders are beneficial predators. A few such as the widow spiders and recluse spiders are venomous and should be avoided. There are about 900 species of spiders in Texas and only a few are mentioned here.



Key Characteristics: Spiders are wingless and lack antennae. Most have six or eight eyes and bodies variable in size and shape. Young and adults have eight legs and a pair of palpi by the mouth. Size ranges from 1/8 inch to more than four inches.

## Order Opiliones

(harvestmen)



photo credit: Edward L. Manigault

Metamorphosis: simple: egg, young, adult

Mouthparts: weak chewing

Biology: Worldwide, there are 37 families of harvestmen. Eighteen species are reported from Texas. Members of only one family, Phalangidae, are properly referred to as "daddy longlegs."

Key Characteristics: Harvestmen have a globular body. They can be separated from spiders which have two distinct body segments because harvestmen have the entire body as one unit. The abdomen is distinctly segmented and the two eyes are mounted on a large dorsal tubercle on the top surface of the body (carapace). While most species have extremely long spindly legs, there are species with shorter legs.

## Order Scorpiones

young, adult (scorpions)



Metamorphosis: simple: egg,

Mouthparts: chewing

Biology: Scorpions are easily recognized by the pincers on the first set of appendages (pedipalps), the long tail with a stinger at the end and the flattened appearance of the body. They have four pairs of walking legs. Scorpions have two eyes on the top of the head region and usually two to five along the side of the head. Nevertheless, they do not see well and rely more on the sense of feel for most of their activities. Between the last pair of legs is a comb-like structure of pectines used to identify substrate structures and for chemoreception of pheromones. There are about 18 species of scorpions in Texas; many of these are uncommon or are known only locally. *Centruroides vittatus* is the only species reported from the eastern half of the state. The number of species increases in the western parts of the state with most species (14) reported in the Big Bend region.

Key Characteristics: Scorpions are wingless, have no antennae and have bodies that are broad near the front and taper to a tail. The tail has a sting at the tip and is often held over the body. All scorpions can sting, but only a few are deadly venomous. Front appendages are enlarged into pincers. They are often found under loose bark of logs or under trash piles. Size ranges from one inch to three inches.

## Order Solifugae



(sunspiders, also called windspiders, sunscorpions, windscorpions)



Metamorphosis: simple: egg, young, adult

Mouthparts: chelicerae

**Biology:** The mouthparts (chelicerae) of windscorpions are formed into large jaws that work vertically and project forward from the mouth. The shape of the head with its enormous jaws is quite distinctive.

**Key Characteristics:** Windscorpions are 3/8 to 2 inches long. Most are yellowish to brown, and have four pairs of legs. The pedipalps are thin and used like feelers. The first pair of legs are more slender than the others and act as sense organs. The males often have a more slender body, which is often longer than in the females. With their longer legs, males look bigger.

## Order Thelyphonida



young, adult (whipscorpion or vinegaroon)

Metamorphosis: simple: egg,

Mouthparts: pedipalps



**Biology:** The only species that occurs in Texas is *Mastigoproctus giganteus* (Lucas) which is a vinegaroon in the family Thelyphoridae. Our Texas species is nearly black. Bodies of adults are 1 to 3 inches long. It is found primarily in west Texas especially in the Trans-Pecos region but has been reported as far north as the Panhandle and in south Texas.

**Key Characteristics:** Whipscorpions have heavy mouthparts (pedipalps) that are formed into pincers. The first pair of legs is long and thin and is used like antennae to feel their way around. The next three pairs of legs are used for walking. The abdomen is attached widely to the head-thorax region (cephalothorax). The tail is long and thin suggesting a whip which is where the common name, "whipscorpion", originates.

## Subphylum Myriapoda, Class Chilopoda

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### Centipedes



Derivation: Latin, “hundred (centi) and “foot” (pedis)

Metamorphosis: simple: egg, young, adult

Mouthparts: piercing and chewing

Biology: Centipedes are generally predators which feed on insects and other arthropods. They pierce the prey to kill or disable it. They are active mostly at night and they can move quickly. One large species in Texas in the genus *Scolopendra* is large enough to be a hazard to humans.

Key Characteristics: Centipedes can easily be distinguished from millipedes by counting the number of pairs of legs arising from most body segments. Centipedes have one pair of legs per body segment, with the first pair of legs being modified into venomous fangs. Centipedes are generally flattened and have a pair of well-developed antennae on the head.

## Subphylum Myriapoda, Class Diplopoda

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### Millipedes



Derivation: Latin, “thousand (milli) and “foot” (pedis)

Metamorphosis: simple: egg, young, adult

Mouthparts: chewing

Biology: Millipedes are usually scavengers on dead arthropods and organic matter. They are active mostly at night and usually are slow-moving. Millipedes can be a nuisance when they enter homes. There are a few species that may damage field crops or greenhouse plantings.

Key Characteristics: Millipedes have two pairs of legs per body segment. The body is generally rounded but some species have extensions on each segment. Some species emit foul-smelling defensive fluids through openings along the sides of the body. The fluids can cause brown discoloration of skin with which it comes in contact, and in some cases the fluids are strong enough to kill insects that are placed in the same container. Some of these fluids contain hydrogen cyanide.

## Subphylum Hexapoda, Class Entognatha

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### Order Collembola

ametabolous, none (springtails)



Metamorphosis:

Mouthparts: chewing

Biology: Until recently, springtails were classified as insects. They are common in moist locations and in leaf mold. Some species are important pests in greenhouses, mushroom cellars and earthworm beds. Springtails are abundant on the soil surface but are easily overlooked.

Key Characteristics: Collembola are tiny, wingless, with spring-like apparatus on abdomen. They jump by means of a tail-like appendage that folds under the body. The body is elongate or globular, usually microscopic, but sometimes larger than 1/8 inch. They are usually white, but some are yellowish brown or gray.

## Subphylum Crustacea, Class Malacostraca

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### Order Isopoda

(sowbugs and pillbugs)



photo credit: David Cappaert

Metamorphosis: simple: egg, young, adult

Mouthparts: chewing

Biology: Sowbugs and pillbugs are generally scavengers. They prefer moist habitats with organic matter. They hide during the day under rocks, boards, or other structures.

Key Characteristics: Adults grow to about 3/8 inch long, have a number of rounded body segments and seven pairs of legs. Sowbugs possess a pair of tail-like structures on the back end of the body. Pillbugs do not have these structures and are capable of rolling into a tight ball when disturbed, a behavior that resulted in their common name, "roly-polies".