

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

Distance Master of Science in Entomology
Projects

Entomology, Department of

2022

A Beginner's Guide to Arthropod ID

Kristen A. Lewis

Follow this and additional works at: <https://digitalcommons.unl.edu/entodistmasters>








Part of the [Entomology Commons](#)






This Article is brought to you for free and open access by the Entomology, Department of at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Distance Master of Science in Entomology Projects by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.



A BEGINNER'S GUIDE TO ARTHROPOD ID

By: Kristen A. Lewis

Classification	Morphological Identification	Images
<p>Spiders and Scorpions</p> <p>Kingdom: Animalia Phylum: Arthropoda Subphylum: Chelicerata Class: Arachnida (spiders and scorpions) Order: Scorpiones (scorpions) Order: Palpigradi (micro whipscorpions) Order: Uropygi (whipscorpions) Order: Schizomida (short- tailed whipscorpions) Order: Amblypygi (tailless whipscorpions) Order: Araneae (spiders)</p>	<p>Scorpiones</p> <ol style="list-style-type: none"> 1. Possess a narrow five-segmented posterior metasoma that terminates in a sting. 2. The prosoma has a pair of eyes near the midline and two to five along the lateral margin on each side. 3. Most catch insects with pedipalps which are sometimes formed into claws. *Ametabolous <p>Palpigradi</p> <ol style="list-style-type: none"> 1. Most species are minute 5 mm with a long, segmented tail. 2. The pedipalps are leglike; the first pair of legs is the longest. <p>Uropygi</p> <ol style="list-style-type: none"> 1. The body is elongate and slightly flattened; maximum length 80 mm and total length including tail 150 mm; they are slender, segmented and slightly flattened at the tail which is as long as the body with no stinger. 2. Possess powerful pedipalps. 3. The first pair of legs are slender and used as feelers; they have only three pairs hind legs used for walking. <p>Schizomida</p> <ol style="list-style-type: none"> 1. Most are small and slender; the terminal appendage is not long and whiplike. 2. The pedipalps arch upward and forward and move vertically with a transverse suture on prosoma. 3. The first legs are slender and not used for walking; the fourth legs are modified for jumping. 4. No venom glands or eyes are present. <p>Amblypygi</p> <ol style="list-style-type: none"> 1. Most are somewhat spiderlike with a distinctly segmented opisthosoma – not petiolate. 2. No spinnerets are present. 3. The pedipalps are large, powerful, and spiny – used for capturing prey. 4. The first legs long and whiplike. 5. The prosoma is wider than long with rounded sides. 6. No venom glands are present. <p>Araneae</p> <ol style="list-style-type: none"> 1. The body is divided into two regions, the cephalothorax and abdomen; the 	<p>Scorpiones</p>  <p>Palpigradi</p>  <p>Uropygi</p>  <p>Schizomida</p>  <p>Amblypygi</p> 

	<p>abdomen is unsclerotized and attached to the cephalothorax by a narrow pedicel.</p> <ol style="list-style-type: none"> The cephalothorax bears eyes, mouthparts, legs, pedipalps, and stomach. The abdomen contains the primary reproductive structures, respiratory system, intestine, anus, silk glands, and spinnerets. They have eight simple eyes, less in some species; eye arrangement is important in identification. The chelicerae have two segments, base and fangs with an opening for the poison gland near the tip. Four pairs of ambulatory legs with seven segments and two or three terminal claws. The spinnerets are usually on the posterior end of the abdomen. 	<p>Araneae</p> 
<p>Sow Bugs</p> <p>Kingdom: Animalia Phylum: Arthropoda Subphylum: Crustacea Class: Malacostraca Order: Isopoda (sow bugs)</p>	<p>Isopoda</p> <ol style="list-style-type: none"> They are dorsoventrally flattened. The last thoracic segments are distinct and have leglike appendages. The abdominal segments are more or less fused. <p>*Ametabolous</p>	<p>Isopoda</p> 
<p>Millipedes, Centipedes & Pauropods</p> <p>Kingdom: Animalia Phylum: Arthropoda Subphylum: Atelocerata Class: Diplopoda (millipedes) Class: Chilopoda (centipedes) Class: Pauropoda (pauropods)</p> <p>*All are ametabolous</p>	<p>Diplopoda</p> <ol style="list-style-type: none"> They have an elongate and wormlike body, and are cylindrical or slightly flattened. They have thirty (30) or more pairs of legs; most body segments bear two pairs of legs. The antennae are short and usually seven-segmented. <p>Chilopoda</p> <ol style="list-style-type: none"> They are elongate and flattened. Each body segment has one pair of legs; the last two pair of legs are directed backwards and often different in form. The antennae have 14 segments. <p>Pauropoda</p> <ol style="list-style-type: none"> Most are minute 1.0-1.5 mm and usually whitish in color. The antennae have three apical branches. They have nine pairs of legs; legs are not grouped in double pairs. They have a small head sometimes covered by a tergal plate over the first body segment. 	<p>Diplopoda</p>  <p>Chilopoda</p>  <p>Pauropoda</p> 

Proturans, Springtails & Diplurans

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Hexapoda
Order: Protura (proturans)
Order: Collembola (springtails)
Order: Diplura (diplurans)

Protura

1. They are minute whitish hexapods.
2. The head is somewhat conical.
3. They have no eyes or antennae.
4. The first pair of legs are primarily sensory and carried in an elevated position.

Collembola

1. They have a forked structure, furcula, which propels them through the air.
2. Many have up to eight ommatidia on each side of the head.
3. The antennae are short, usually four-segmented.
4. The tarsi are one-segmented and fused with tibiae.

Diplura

1. They lack a median caudal filament; there are two caudal filaments.
3. The body is usually not covered with scales.
4. Compound eyes and ocelli absent.
5. The tarsi are one-segmented.

*All are ametabolous

Protura



Collembola



Diplura



Bristletails & Silverfish

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Apterygota (wingless insects)
Order: Microcoryphia (bristletails)
Order: Thysanura (silverfish)

Microcoryphia

1. The body is cylindrical with a somewhat arched thorax.
2. The compound eyes are large and contiguous; ocelli always present.
3. The tarsi are three-segmented.
4. The body is covered with scales.

Thysanura

1. They are medium to small and usually elongate and somewhat flattened.
2. They have three tail-like appendages at the posterior end of the abdomen.
3. The body is usually covered in scales.
4. The small compound eyes are widely separated; ocelli are present or absent.

*All are ametabolous

Microcoryphia



Thysanura



Mayflies

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Ephemeroptera (mayflies)

Ephemeroptera

1. They are small to medium-sized, elongate and very soft-bodied.
 2. They have two or three long, threadlike tails.
 3. They have membranous wings with numerous veins; the wings are held together above the body.
 4. The antennae are small and bristle-like.
 5. The immature stages are aquatic.
- *Hemimetabolous/simple with aquatic nymphs/naiads

Ephemeroptera



Dragonflies & Damselflies

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Odonata (dragonflies and damselflies)
Suborder: Anisoptera (dragonflies)
Suborder: Zygoptera (damselflies)

Odonata

1. They have large, multifaceted compound eyes which often take up most of the head; there are three ocelli.
2. The antennae are small and bristlelike.
3. They have a small prothorax and larger pterothorax.
4. They have four wings which are elongate and membranous with many veins.
5. The legs are long and suited for perching and catching prey on the wing – not for walking.
6. They have a long, slender abdomen with 10 visible segments; the cerci are not segmented.
7. They have chewing/mandibulate mouthparts.

Anisoptera

1. The hind wings are wider at the base than the front wings and are held horizontally at rest.
2. Males have three appendages at the abdomen posterior tip with two cerci and one epiproct.

Zygoptera

1. Front and hind wings similar in shape and both narrowed at base and are held together above body or slightly divergent.
2. Males have four appendages at posterior end of abdomen, two cerci and two periprocts.

*Hemimetabolous/simple with aquatic nymphs/naiads

Anisoptera



Zygoptera



Grasshoppers, Crickets & Katydid

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Exopterygota (simple body change during growth)

Order: Orthoptera (grasshoppers, katydids and crickets)

Suborder: Caelifera (grasshoppers)

Suborder: Ensifera (crickets)

Superfamily: Tettigoniodea (katydids)

Orthoptera

1. They may be winged or wingless; winged forms usually have four wings; front wings are usually elongate with many veins and are thickened – called tegmina; hind wings are membranous, wide with many veins and folded fan-like under tegmina at rest.

2. The body is elongate and cerci have one to many segments.

3. The antennae are somewhat long – sometimes longer than body – and with many segments; many species have a long ovipositor – sometimes longer than body.

4. The tarsi usually have three to four segments.

5. They have chewing/mandibulate mouthparts.

*Hemimetabolous

Caelifera

1. The hind femora are more or less enlarged for jumping.

2. They have relatively short antennae.

3. The tarsi are three or fewer segmented

4. The tympana, if present, is located on the first abdominal segment.

5. They stridulate by rubbing the hind femora across the tegmina or abdomen or by snapping the wings in flight.

6. They have short cerci and an ovipositor (in females).

Ensifera

1. The hind femora are more or less enlarged for jumping.

2. The antennae are usually long and hairlike.

3. The tarsi have three or four segments.

4. The tympana, if present, is located on the upper ends of the front tibiae.

5. Stridulation occurs by rubbing the edge of one front wing over a file-like ridge on the ventral side of the other front wing.

6. Most have a long ovipositor, either sword-shaped or cylindrical.

Tettigoniodea

1. The antennae are long and hair-like.

2. The tarsi are four-segmented.

3. The tympana, if present, are located at the base of the front tibiae; each species has a characteristic song.

4. They have a flattened, blade-like ovipositor.

5. Within suborder, Ensifera.

Caelifera



Ensifera



Tettigoniodea



Walkingsticks

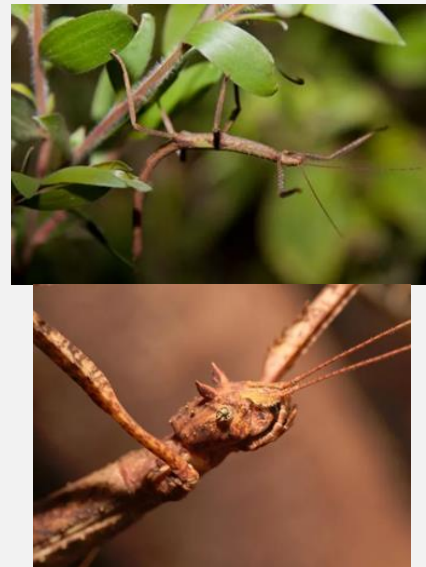
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Phasmatodea (walkingsticks)

Phasmatodea

1. They do not have enlarged femora and do not jump.
2. The tarsi are usually five-segmented.
3. They have an elongated, stick-like body.
4. The wings are reduced or absent.
5. Some tropical species are flattened and resemble leaves.
6. They lack tympana and stridulatory organs.
7. The cerci are short and one-segmented; the ovipositor is short and concealed by the abdomen.
8. They can partly regenerate lost legs.
9. The young are green and adults are brown.

**Hemimetabolous/incomplete metamorphosis*

Phasmatodea



Rock Crawlers

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Grylloblattodea (rock crawlers)

Grylloblattodea

1. They are slender and elongate, usually 15-30 mm.
2. The body is pale and finely pubescent.
3. The eyes are small or absent; ocelli are absent.
4. The antennae are long and filiform with 23 – 45 segments.
5. The cerci are long with 5 or 8 segments; the ovipositor is sword-shaped.
6. They have mandibulate mouthparts.

**Hemimetabolous/incomplete metamorphosis*

Grylloblattodea



Gladiators

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Mantophasmatodea (gladiators)

Mantophasmatodea

1. They are small, 2-3 cm.
2. Both males and females are wingless.
3. They have mandibulate mouth parts.
4. The antennae are long and filiform.
5. The tarsi are five-segmented.
6. The forelegs not modified for prey capture as in mantids.

**Hemimetabolous/incomplete metamorphosis*

Mantophasmatodea



Earwigs

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Dermaptera (earwigs)

Dermaptera

1. They are elongate, slender and somewhat flattened.
2. The cerci are shaped into forceps.
3. Adults are winged or wingless with two pairs of wings.
4. In winged forms, front wings are short, leathery and without veins - usually called tegmina or elytra; hind wings are rounded and membranous with radiating veins.
5. When at rest, hind wings are folded under front wings with only the tips showing.
6. The tarsi have three segments.
7. They have mandibulate mouthparts.

*Hemimetabolous/simple

Dermaptera



Stoneflies

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Plecoptera (stoneflies)

Plecoptera

1. They are medium to small and somewhat flattened, soft bodied and with drab coloring.
2. They are poor flyers and are seldom found far from water.
3. Most have four membranous wings; front wings are elongate and narrow with many crossveins; hind wings are slightly shorter than front wings and have well-developed anal lobe that is folded when at rest.
4. Wings are held flat over the abdomen at rest.
5. The antennae are slender, long and many-segmented.
6. The tarsi are three-segmented.
7. The cerci, if present, are long or short.
8. They have reduced mandibulate mouthparts.

*Hemimetabolous/aquatic naiads

Plecoptera



Web-Spinners

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Embiidina (web-spinners)

Embiidina

1. Small and slender, ≈ 10 mm; mostly tropical.
2. Adult males are somewhat flattened; females and young are cylindrical.
3. Antennae are filiform.
4. Ocelli are lacking.
5. Mandibulate mouthparts.
6. Legs are short and stout; tarsi are three-segmented; hind femora are greatly enlarged; basal segment of front tarsus enlarged and contains silk glands.
7. Most males are winged; females are always wingless and have vestigial wing; wings are similar in shape and size.
8. Cerci are two-segmented.

*Hemimetabolous/simple

Embiidina



Zorapterans

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Exopterygota (simple body change during growth)

Order: Zoraptera (zorapterans)

Zoraptera

1. They are tiny – 3 mm or less in length.
2. They may be winged or wingless; winged species are usually dark, whereas wingless species are pale; there are four wings with reduced venation and hind wings are smaller than front wings.
3. The antennae are moniliform with nine segments.
4. Wingless forms lack compound eyes and ocelli; winged forms have compound eyes and three ocelli.
5. The tarsi are two-segmented; each tarsus has a claw.
6. The cerci are short and unsegmented with a terminal bristle.
7. They have mandibulate mouthparts.

*Hemimetabolous/simple

Zoraptera



Mantids

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Exopterygota (simple body change during growth)

Order: Mantodea (mantids)

Mantodea

1. They are large, elongate and slow-moving with raptorial front legs.
2. The prothorax is greatly lengthened and flexibly attached to the pterothorax; the front coxae are very long and flexible.
3. The front femora and tibia are armed with strong spines and fitted for grasping prey.
4. The head moves freely; they can look over their shoulders.
5. Their triangular heads have bulging compound eyes.
6. They may be winged or wingless.
7. They hold their body in an upright posture, ready to capture prey with raptorial front legs.

*Hemimetabolous/simple with ootheca

Mantodea



Cockroaches

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Blattodea (cockroaches)

Blattodea

1. They have an oval, flattened body with the head concealed from above by the pronotum.
2. The tarsi are five-segmented; legs are cursorial for walking/running, they run fast.
3. Tympana and stridulating organs are usually absent.
4. The wings are usually present; in some species females' wings are shorter than males.
5. The cerci are one to many-segmented and usually long.
6. The antennae are long and filiform.

*Hemimetabolous/simple with ootheca

Blattodea



Termites

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Isoptera (termites)

Isoptera

1. They are medium-sized social insects; colonies are individualized morphologically into distinct forms/castes of reproductives, workers, and soldiers that perform different functions.
2. Reproductives have four membranous wings; front and hind wings are closely matched in size.
3. The antennae are filiform or moniliform.
4. Workers and reproductives have mandibulate mouthparts.

*Hemimetabolous/nymphs may develop into any caste form

Isoptera



Bugs, Aphids, Scale Insects, Hoppers, Cicadas, Psyllids & Whiteflies

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Exopterygota (simple body change during growth)

Order: Hemiptera (bugs, aphids, scale insects, hoppers, cicadas, psyllids, and whiteflies)

Suborder: Heteroptera

Suborder: Auchenorrhyncha

Suborder: Sternorrhyncha

Hemiptera – true bugs

1. They have elongated mouthparts/rostrum adapted for sucking; mandibles and maxillae are modified into stylets lying in a grooved, segmented labium.

2. Cerci not present.

Heteroptera

1. There is a division of forewing into two parts; the proximal part is relatively stiff/hemelytron and horny, while the apical part is membranous; the forewings usually lie flat on the abdomen with membranes overlapping.

2. The head is triangular with partly protruding spherical eyes.

3. The antennae have few long, cylindrical segments \approx equal in length.

4. The pronotum is usually large, transverse and obvious.

Auchenorrhyncha

1. Hemielytra are not present; the front wings are either entirely horny and brightly colored or entirely membranous; forewings are usually held at an angle along the sides of the abdomen like a pitched roof.

2. The head is shaped like a boat prow with sunken eyes and the front sloping backwards from dorsal to ventral.

3. The rostrum continues in a straight line from the front of the head with straight mouthparts.

4. The antennae are short with bristles arising from the tip of the articulated basal segment.

Sternorrhyncha

1. They have belly mouthparts arising behind the front of the head; the head is close to the base of the front legs.

2. Their membranous wings are usually held at the side of the abdomen at rest.

3. Antennae are variable, usually of obvious length, and thread-like with segments roughly equal in length but get shorter at the tip.

*Hemimetabolous/whiteflies and scale insects come close to complete metamorphosis - last nymphal instar is quiescent and pupa-like

Heteroptera



Auchenorrhyncha



Sternorrhyncha



Thrips

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Thysanoptera (thrips)

Thysanoptera

1. They are tiny and slender-bodied 0.5-5.0 mm.
2. Wings may be present or absent; when four wings are fully developed, they are long and narrow with few or no veins, and may be fringed with long hairs.
3. They have sucking “punch and suck” mouthparts with a stout, conical proboscis and asymmetrical structure located on the ventral surface of the head; both maxillary palps are present, but short.
4. The antennae are short and four- to nine-segmented.
5. The tarsi are one- or two-segmented with one or two claws and bladderlike at the tip.
6. The ovipositor is sometimes present; in those without an ovipositor, the abdomen is tubular at the posterior end.

**Intermediate between hemimetabolous and holometabolous/between simple and complete*

Thysanoptera



Barklice & Booklice

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Exopterygota (simple body change during growth)
Order: Psocoptera (psocids, barklice)

Psocoptera

1. They are small and soft-bodied - less than 6 mm.
2. Wings may be present or absent; both short- and long-winged species occur; winged species have four membranous wings and sometimes two with vestigial hindwings; forewings are slightly larger than hindwings; the wings at rest are held roof-like over abdomen.
3. The antennae are usually long.
4. The tarsi are two- or three-segmented.
5. Cerci are lacking.
6. They have mandibulate mouthparts with an enlarged clypeus.

**Hemimetabolous/simple*

Psocoptera



Lice

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Exopterygota (simple body change during growth)

Order: Phthiraptera (chewing and sucking lice)

Suborder:

Rhynchophthirina (lice of elephants and African pigs)

Suborder: *Amblycera* (lice of guinea pigs, Neotropical mammals, marsupials, dogs, and birds)

Suborder: *Ischnocera* (lice of birds and mammals)

Suborder: *Anoplura* (lice of seals, sea lions, walruses, river otters, squirrels, pigs, cattle, horses, deer, rodents, insectivores, cattle, sheep, goats, deer, dogs, foxes, coyotes, peccaries, humans, and rodents)

Phthiraptera

1. They are small, wingless parasites of mammals and birds.

2. The mouthparts of sucking lice are highly specialized and adapted to parasitic hosts; the mouthparts of chewing lice are mandibulate.

3. The eyes are usually reduced or absent; ocelli are absent.

4. The antennae are short with three to five segments.

5. The tarsi of sucking lice are one-segmented with a single, large claw.

*Hemimetabolous/simple

Rhynchophthirina



Amblycera



Ischnocera



Anoplura



Beetles

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Endopterygota (complex body change during growth)

Order: Coleoptera (beetles)

Suborder: Adephaga

Suborder: Polyphaga

Coleoptera

1. They have mandibulate mouthparts with mandibles, maxillae and labium clearly identifiable.

2. The pronotum is usually the only obvious part of the thorax visible from above.

3. The mesothorax and metathorax are usually concealed by the front wing case/elytra; a small triangular mesoscutellum extending from the mesothorax may show between the elytra at the boundary of the pronotum; the elytra have several characteristics used in identification.

4. Legs are walking or swimming type.

5. Forewings/elytra are held out sideways in flight; hindwings are used in flight.

6. Must examine ventral view of abdomen to determine suborder.

Adephaga

1. Most are water beetles.

2. They have an incomplete first abdominal segment.

3. Terrestrial species viewed from above, have a silhouette that narrows behind the head and behind the pronotum; notches in the silhouette identify divisions between the head, pronotum and elytra.

4. Antennae and tarsi are simple filiform; antennae are composed of 11 segments; tarsi are five-segmented on all three pairs of legs.

Polyphaga

1. The first abdominal segment is complete ventrally.

2. The antennae are variable and often not filiform.

3. Either the divisions between the head and pronotum, or the pronotum and elytra, or both are not distinguishable in silhouette.

*Holometabolous/complete metamorphosis

Adephaga



Polyphaga



**Alderflies, Dobsonflies,
Antlions, Lacewings,
Mantidflies & Fishflies**

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Endopterygota (complex body change during growth)
Order: Neuroptera (alderflies, dobsonflies, antlions, lacewings, mantidflies, and fishflies)
Suborder: Megaloptera
Suborder: Planipennia

Neuroptera

1. They have “net-veined” wings with many longitudinal and cross veins; veins often double up by forking near the wing margin; wings are usually large and transparent and sometimes with colored patches.
2. The wings are held rooflike along the sides of the body when at rest.
3. Adults have long, simple antennae.
4. They have mandibulate mouthparts.

Megaloptera

1. Wing veins do not bifurcate at margins; if they do, the prothorax is elongated.
2. Larvae have mandibulate mouthparts.

Planipennia

1. Wing veins bifurcate at the margins.
2. Larvae have long suctional mandibles.

**Holometabolous/complete metamorphosis*

Megaloptera



Planipennia



Ants, Bees, Wasps & Sawflies

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Endopterygota (complex body change during growth)
Order: Hymenoptera (ants, bees, wasps, and sawflies)
Suborder: Symphyta (sawflies)
Suborder: Apocrita (ants, bees, wasps and parasitic wasps)

Hymenoptera

1. They have two pairs of wings coupled by a row of hooks/hamuli on the leading edge of the hind wing that hooks into a fold on the trailing edge of the front wing.
2. Most species have a constriction/petiole near the front of the abdomen that divides the abdomen; the first abdominal segment is attached to the thorax – called propodeum – and the posterior part is called the gaster.
3. Antennae are usually obvious with the most distinction between the first segment/scape and second segment/pedicel, with remaining apical segments similar and forming the flagellum.
4. Many have a pigmented spot – pterostigma or stigma – on the forewing near the tip.
5. Wing venation is often reduced and absent in some species.
6. The tibia often ends in spurs.
7. Females usually have a distinct ovipositor, which may be modified into a stinger.

Symphyta

1. There is no waste/petiole in the abdomen.
2. Adult and larval mouthparts are mandibulate.
3. Wing venation is more extensive than in other Hymenoptera.

Apocrita

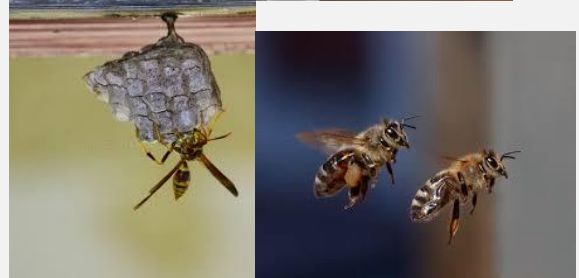
1. The waste is constricted in a petiole, sometimes pushing the abdomen downwards.
2. Some are social – some bees, wasps and bumble bees.
3. The ovipositor, when present, is often modified as a short stinger.

*Holometabolous/complete

Symphyta



Apocrita



Caddisflies

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Endopterygota (complex body change during growth)

Order: Trichoptera (caddisflies)

Trichoptera

1. They are small to medium and dull in coloration; few have conspicuous patterns; they are similar to moths in appearance.

2. They have four membranous wings with hairs and sometimes scales, held roof-like over abdomen.

3. Antennae are long and slender.

4. They have mandibulate mouthparts with well-developed palps and reduced mandibles.

5. Larvae are aquatic and caterpillar-like; some larvae build cases, some build nets, and some are free-swimming.

6. Wing venation in adults is generalized with few crossveins; most are weak flyers.

*Holometabolous/complete

Trichoptera



Butterflies, Skippers & Moths

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Endopterygota (complex body change during growth)

Order: Lepidoptera (butterflies, skippers, and moths)

Lepidoptera

1. The wings and most of the body and legs are covered with scales.
2. Most have mouthparts fitted for sucking; the labrum is small and usually in the form of a transverse band across the lower part of the face at the base of the proboscis; mandibles are usually lacking; when present, the proboscis is formed by the appressed, longitudinally grooved galeae of the maxillae and is usually long and coiled.
3. Large compound eyes are present and consist of large numbers of facets; most moths have two ocelli.
4. Several families have auditory organs/tympana which may function in detecting high-frequency echolocation sounds made by bats.

**Holometabolous/complete*

Lepidoptera



Fleas

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Endopterygota (complex body change during growth)

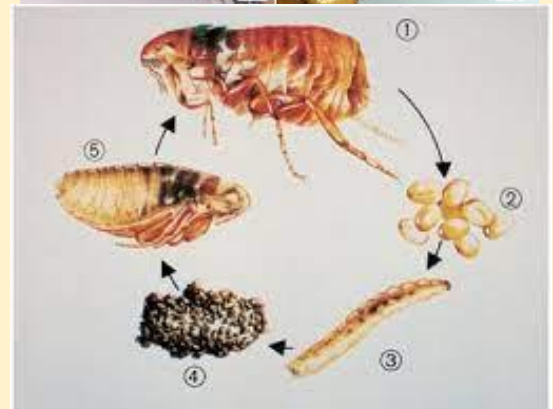
Order: Siphonaptera (fleas)

Siphonaptera

1. They are small and wingless.
2. They feed on warm-blooded vertebrates.
3. Larvae are free-living and feed on organic material in the larval habitat.
4. Adult bodies are usually laterally compressed and have caudally directed setae and spines that expedite forward movement through host hair, feathers or fur and resist backward movement associated with host grooming.
5. Adults have shiny, hairy bodies with coloration ranging from black to light, yellowish brown.
6. The head usually has a single tubercle on the frontal margin and a variable number of preantennal setal rows.
7. One pair of eyes may be present or absent; the genal lobe extends below and behind the eye and may have a comb of two or more spines.
8. The thorax includes three distinct and somewhat separate segments; the pronotum may have one to three rows of setae and often a distinct comb along its caudal margin.
9. Legs are walking or jumping type; exceptions include species that attach to the host and are restricted to the nest.
10. Most adult fleas have eight segments in the abdomen and a compound terminal area with indistinct segmentation.

*Holometabolous/complete

Siphonaptera



Scorpionflies & Hangingflies

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Endopterygota (complex body change during growth)
Order: Mecoptera (scorpionflies)

Mecoptera

1. They are medium sized 9-25 mm and slender-bodied.
2. The head protrudes below the eyes as a beak or rostrum; the rostrum is formed from the elongation of the clypeus.
3. Most have four long, narrow, membranous wings; front and hindwings are similar in shape, size and venation.

Scorpionflies

1. In male scorpionflies, the genital segment is bulbous and often curved forward above the back; they cannot sting; the abdomen of females tapers posteriorly and has two short, fingerlike, apical cerci.
2. Most are yellowish brown to almost black.
3. The wings are mostly transversely banded with interspersed spots.

Hangingflies

1. They are slender 12-22 mm, and light yellowish brown to reddish brown.
2. They have long, slender legs and narrow wings and resemble large craneflies; the wings are narrower near the base.
3. They are unable to stand and mostly hang by their front legs or front and middle legs from stems or leaf edges.

*Holometabolous/complete

Mecoptera



Twisted-Winged Parasites

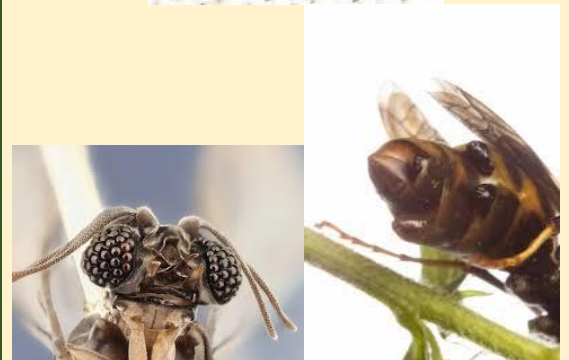
Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Atelocerata
Class: Insecta
Subclass: Pterygota (winged and some wingless insects)
Division: Endopterygota (complex body change during growth)
Order: Strepsiptera (twisted-winged parasites)

Strepsiptera

1. They are minute and parasitic on other insects.
2. Males and females are very different; males are winged and free-living, while females are wingless, often legless and most do not leave the host.
3. Males have protruding, raspberry-like eyes and antennae with elongate processes on some segments; the front wings are reduced to clublike structures that resemble halteres in Diptera; hind wings are large, fanlike and membranous with reduced venation.
4. Females of parasitic species usually lack eyes, legs and antennae and body segmentation is indistinct; free-living females have a distinct head with simple four- or five-segmented antennae, mandibulate mouthparts and compound eyes.

*Hypermetamorphosis

Strepsiptera



Flies & Mosquitoes

Kingdom: Animalia

Phylum: Arthropoda

Subphylum: Atelocerata

Class: Insecta

Subclass: Pterygota (winged and some wingless insects)

Division: Endopterygota (complex body change during growth)

Order: Diptera (flies and mosquitoes)

Suborder: Nematocera (long-horned flies)

Suborder: Brachycera (short-horned flies)

Diptera

1. They have one pair of wings; hind wings are reduced to small knobs/halteres which aid with equilibrium.

2. Most are small and soft-bodied.

3. Mouthparts are sucking type with varying structure; many are piercing, and many are sponging or lapping.

Nematocera

1. The antennae are long and have many segments.

2. Most are small, slender and mosquito-like.

3. Wing venation varies from complete to greatly reduced.

4. Many are bloodsucking and serve as disease vectors.

Brachycera

1. Most are stout-bodied and vary greatly in size.

2. Antennae usually have three segments; the third segment is sometimes divided and often has a style or arista.

*Holometabolous/complete

Nematocera



Brachycera



References

Triplehorn, C. A. & Johnson, N. F. (2005). *Borror and Delong's Introduction to the Study of Insects*, 7th Edition. United States of America: BROOKS/COLE, CENGAGE Learning.

Van Emden, H. F. (2013). *Handbook of Agricultural Entomology*. Oxford, United Kingdom: Wiley-Blackwell.

<https://creativecommons.org/>. Accessed in October 2022.

Lewis, K. A. (2022). Photographs taken of tarantula, tiger crane flies and Jerusalem cricket. Not copyrighted.