CHAPTER 3

INSECTA
(Aquatic Insects)

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Aquatic insects are a very abundant and diverse group that inhabits a variety of aquatic environments. These organisms are an important component of aquatic (and sometimes terrestrial) food webs because they break down and process organic matter and provide food for invertebrates and vertebrates (e.g., fish, birds). Despite their importance in aquatic ecosystems, very few insects spend their entire lives submerged in water. Most aquatic insects undergo an aquatic immature stage followed by a terrestrial adult (e.g., Ephemeroptera, Odonata, Plecoptera, Trichoptera, Megaloptera). Even in cases where both the larva and adult are aquatic, often the adult can usually exit the water and/or the pupal stage is terrestrial. In rare cases, the larva is terrestrial and the adult is aquatic (e.g., Dryopidae). Additionally, many species considered are semiaquatic and are only associated with aquatic and semiaquatic vegetation, the water’s surface, or the margins of water habitats.

**Insect Morphology**

Adult insects are characterized by the presence of three pairs of segmented legs and the presence of wings in most species (Figure 3.3 - the fore wings are modified into hardened protective coverings that conceal the membranous hind wings).

Many aquatic insect larvae possess three pairs of segmented legs (Figure 3.1), but in some groups segmented legs are absent (e.g., Diptera [see Figure 3.4]). Characteristics are often related to the type of metamorphosis a group undergoes. For example, insects with incomplete metamorphosis have immature stages that appear relatively similar to the adult (e.g., Ephemeroptera, Odonata, Plecoptera, and Hemiptera). These taxa can be identified by the presence of three segmented legs and generally the presence of wing pads in mature larvae (Figure 3.1).

![Figure 3.1: Dorsal view of ephemeropteran larva.](https://example.com/figure3.1.png)
Most of these groups have aquatic larvae and terrestrial adults. However, many Hemiptera and Coleoptera do not follow this generalization. Insects with complete metamorphosis possess immature stages that are very different than the adults (e.g., Trichoptera, Diptera, Coleoptera, Neuroptera, Megaloptera, Hymenoptera, and Lepidoptera). In these groups there are no wing pads present in the immature stages and segmented legs may or may not be present (Figure 3.2, Figure 3.4). In some cases the larvae of holometabolous insects have reduced head structures and appear worm-like. Holometabolous adults are also usually terrestrial although many beetles (Coleoptera) are aquatic as adults.

Figure 3.2: Lateral view of trichopteran larva.
Figure 3.3: Dorsal view of coleopteran adult.

Figure 3.4: Lateral view of dipteran larva.
Key to Insecta Orders

1. Thorax with three pairs of segmented legs (Figure 3.6, Figure 3.5, Figure 3.7, Figure 3.8)...

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1'. Thorax lacking segmented legs (Figure 3.10, Figure 3.9, Figure 3.11) ......................................

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Diptera - larvae and pupae [in part]
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Figure 3.6: Chimarra sp. (Philopotamidae) larva, Lateral View.

Figure 3.5: Calopteryx maculata (Calopterygidae), larva, Dorsal View.

Figure 3.7: Hydrobiomorpha sp. (Hydrophilidae) adult, Dorsal View.

Figure 3.8: Leuctra sp. (Leuctridae) larva, Dorsal View.

Figure 3.9: Tipula abdominalis (Tipulidae) larva, Lateral View.

Figure 3.10: Ablabesmyia sp. (Chironomidae) larva, Dorsal View.

Figure 3.11: Brachydeutera prob. argentata (Ephydridae) pupa, Ventral View.
2(1). Fully developed membranous hind wings present – note: the fore wings are often hardened so you may have to lift up the fore wings to see the membranous hind wings (Figure 3.13, Figure 3.12) ........ 3

2'. Fully developed membranous hind wings absent – note: wing pads may be present in some taxa (Figure 3.15, Figure 3.14) .......................................................... 4

3(2). Sucking mouthparts present (Figure 3.17); a portion of the fore wing usually membranous – note: all of fore wing is hardened in the family Pleidae (Figure 3.16) ............ Hemiptera - adults [in part] (aquatic & semiaquatic true bugs) p. 87

3'. Sucking mouthparts absent (Figure 3.18); entire fore wing hardened (Figure 3.19) ......................... Coleoptera – adults (aquatic beetles) p. 138
4(2’). Abdomen ending in 2-3 many-segmented tails (Figure 3.21, Figure 3.20) ............... 5

4’. Multisegmented tails usually absent (Figure 3.24); if tails are present, then only 1-2 tails are present consisting of only 1-2 segments (Figure 3.22, Figure 3.23) ......................... 6

5(4). Abdomen usually ending in 3 tails; if only two tails present then lateral abdominal gills present (Figure 3.25, Figure 3.26); 1 tarsal claw present at the end of each leg ..................

.................................................................... Ephemeroptera – larvae (mayflies) p. 45

5’. Abdomen ending in 2 segmented tails; lateral abdominal gills absent (Figure 3.28, Figure 3.27); two tarsal claws present at the end of each leg .......................................................... Plecoptera – larvae (stoneflies) p. 75
6(4'). Labrum (lower lip) forming an extendable mask-like or scoop-like covering which covers other mouth parts (Figure 3.31 - shaded); abdomen ending in 3 gills (Figure 3.29) or 5 points (Figure 3.30) - **note: gills are sometimes lost** .......................................................... Odonata – larvae (dragonflies & damselflies) p. 63

6'. Not as above ................................................................................................................. 7

7(6'). Sucking (beak-like) mouthparts present (Figure 3.33, Figure 3.34, Figure 3.32)........ 8

7'. Sucking mouthparts absent (Figure 3.36, Figure 3.35) .................................................. 9
8(7). Mouthparts consist of two slender rods held together and projecting forward (Figure 3.37) ............................... **Neuroptera (Sisyridae) – larvae (spongillaflies)** p. 108

8'. Mouthparts consist of a beak held under the head (Figure 3.39, Figure 3.38) ................................. **Hemiptera - larvae and adults [in part]** (aquatic & semiaquatic true bugs) p. 87

9(7'). Wing pads absent (Figure 3.41, Figure 3.40); larvae with freely movable legs (Figure 3.41, Figure 3.40) ................................................................. 10

9'. Wing pads present (Figure 3.43, Figure 3.42); body mummy-like with legs and wing pads held close to body; sometimes in cocoon or case (Figure 3.43, Figure 3.42) (pupae) .... 13
10(9). Abdomen with pairs of leg-like protuberances (ventral prolegs) ending in tiny hooks (crochets) (Figure 3.44) .................. \textit{Lepidoptera – larvae (aquatic moths)} p. 135

![Figure 3.44: Nymphula sp., larva (Pyralidae) larva, Lateral View.](image)

10'. Leg-like protuberances absent from abdomen (Figure 3.46, Figure 3.45); hooks may be present on last abdominal segment (Figure 3.46) ................................................................. 11

![Figure 3.45: Elmidae larva, Lateral View.](image)

![Figure 3.46: Chimarra sp. (Philopotamidae) larva, Lateral View.](image)

11(10'). Antennae extremely small and one segmented (Figure 3.48); last abdominal segment ending in a pair of prolegs with a hook on each (prolegs are sometimes fused) (Figure 3.47) .............................................. \textit{Trichoptera - larvae (caddisflies)} p. 111

![Figure 3.47: Terminal abdominal segments of Rhacophila sp. (Rhacophilidae) larva, Dorsal View.](image)

![Figure 3.48: Head of Agrypnia sp. (Phryganeidae) larva, Dorsal View.](image)

11'. Antennae elongate with more than 3 segments (Figure 3.49, Figure 3.51); if hooks are present on last abdominal segment then a total of four hooks are present (Figure 3.50) ...... ................................................................. 12

![Figure 3.49: Head of Sialis iola (Sialidae) larva, Dorsal View.](image)

![Figure 3.50: Terminal abdominal segments of Gyrinidae larva, Dorsal View.](image)

![Figure 3.51: Head of Enochrus pygmaeus nebulosus (Hydrophilidae) larva, Dorsal View.](image)
12(11'). Tarsi ending in a single claw (Figure 3.53); if two claws are present then the abdomen ends in two slender filaments (Figure 3.54) or four hooks are present on single proleg (Figure 3.52). .................................. **Coleoptera – larvae (aquatic beetles) p. 138**

12'. Tarsi ending in two claws (Figure 3.55); and abdomen either ending in a pair of prolegs each with two hooks (Figure 3.57) or a single slender filament (Figure 3.56). .................................. **Megaloptera – larvae (dobsonflies, fishflies & alderflies) p. 104**

13(9'). One pair of wing pads present (Figure 3.59, Figure 3.58); mandibles if present not extending forward .................................. **Diptera - pupae [in part] (aquatic & semiaquatic true flies) p. 164**

13'. Two pairs of wing pads present (Figure 3.61); curved mandibles present extending forward (Figure 3.60). .................................. **Trichoptera – pupae (caddisflies) p. 111**