COLEOPTERA (BEETLES)

by
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Introduction

Beetles (Coleoptera) form one of the largest groups of insects. In fact, there are more species of beetle known than there are of any other group of insects. Some 350,000 have been described sofar, and many species still await discovery. Except for the Hymenoptera, which may contain an even larger number of species, beetles are the most diverse order of insects.

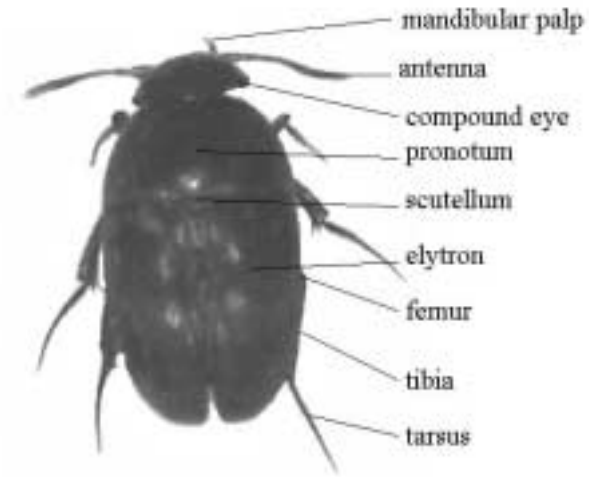

Figure 1 Morphology of a beetle, seen dorsally. The most important body-parts are indicated (photo: Menno Schilthuizen)

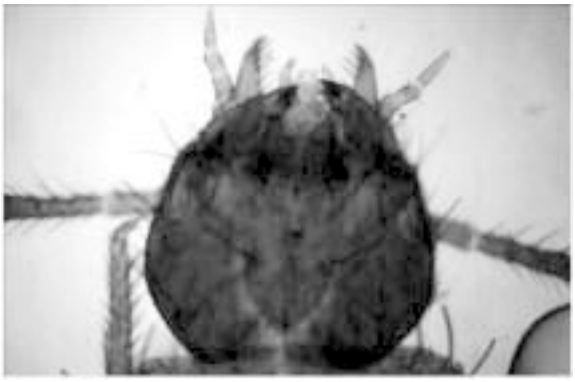

Figure 2 Head of a beetle larva (family Leiodidae). Note that the eyes have fewer facets and the palps and antennae have fewer articles (photo: Menno Schilthuizen)

The design of a beetle has been very successful in evolution. Their forewings have become hard covers under which the soft wings are hidden. This way, the animal is well-protected, while it can still use its hindwings to fly. So it has two ways to protect itself: by its hard "shell" and by flying away.

Although they all have the same basic design, beetles are very diverse in their sizes, their shapes, their colours, the food they eat and the places where they live.

Some of the largest insects are beetles (the giant longhorn beetle from South-America, which can weigh more than 100 grams), and some of the smallest insects are beetles, too (for example, some species of the feather-wing beetles are only 0.035 mm long!). Some beetles, such as ladybirds, are almost as round as a ball, while others, such as the rove beetles, are as long and thin as earwigs. Many beetles are dark-coloured, but several families (such as the aptly-named jewel beetles) have spectacularly brilliant metallic shines. Other families, such as weevils and chafers, have (like butterflies) little scales on their body, which can give them powdery colours, including pure white.

Most beetles, especially in the Tropics, are herbivores: they eat leaves; often one beetle species is specialised on one species of plant. But besides leaf-eaters, almost any food preference is found in the Coleoptera. Some eat snails, some eat caterpillars, some eat bark, some eat fruits, some eat mushrooms. Some eat skin flakes in the fur of mammals, and some only eat dead fish. Except for the ocean, any habitat on earth has beetles living there. The tropical rain forest of course is the richest in species, but deserts, beaches, caves, mountaintops and freshwater all support a rich and interesting beetle fauna.

Where to Look for Beetles in the Forest?

In any patch of tropical rain forest, thousands of species of beetle are found. Many of them are leaf beetles (Chrysomelidae), weevils (Curculionidae), and longhorn beetles (Cerambycidae), which live up in the canopy, feeding on leaves. Some of the larger ones may be seen from a tree platform or canopy walkway, flying from tree to tree. On the ground, there are several ways to find beetles:

Figure 3 Using an inverted umbrella or a similar contraption for collecting beetles knocked from trees (photo: Menno Schilthuizen).

(a) *the understorey*. Herbs and saplings form the understorey layer of plants in the forest. On the leaves, beetles can easily be found. Especially various species of yellow- and blue-coloured leaf beetles (Chrysomelidae) are conspicuous, although they fly quickly and are difficult to catch without a net. A very easy way to get some beetle inhabitants of the understorey is to hold an umbrella upside-down under a sapling or a small tree, and shake the plant. Beetles will fall from the leaves into the umbrella and will take a while before they fly away.

(b) *mushrooms and other fungi*. On dead trees and fallen logs, large fungi are often growing. On the underside of these mushrooms, normally large numbers of mushroom-beetles can be found. Most of them are black with red or yellow dots, which probably signals birds that they are poisonous. These mushroom beetles belong to several families, called the pleasing fungus beetles (Erotylidae) and the Endomychidae, which resemble (and are related to) ladybirds.

(c) *dead wood*. In and on dead trees, either fallen or still standing, many beetles can be found, which feed on wood. Many of these are small, brown or black cylindrical beetles. These are mostly bark beetles or Scolytidae, although many other wood-feeding beetles have a similar apprearance. Also make sure to look under loose bark: pull away the bark with a knife; don't use your hands, because scorpions also live there.

Figure 4 Peeling the bark of dead trees often reveals wood-feeding beetles. But watch out for scorpions and snakes! (photo: Menno Schilthuizen).

(d) *fallen fruit*. Rove beetles (Staphylinidae) and ambrosius beetles (Nitidulidae) are often found in, on, and under fallen fruit. In the case of ambrosius beetles, they feed on the fruit, while the rove beetles usually live there to hunt the larvae of fruit flies.

(e) *dung*. If mammal dung is found on the forest floor, this may be a source of dung beetles (Scarabaeidae). These are usually large and brightly coloured beetles which burrow tunnels under or near the dung which they fill with bits of faeces and lay their eggs in them. Rove beetles can also be found frquently on dung, mostly feeding on other insects that are atracted to it.

(f) *freshwater*. Small streams or pools in the forest can harbour various kinds of water-loving beetles: whirligigs (Gyrinidae), which ride in swift circles on top of the water, usually in groups. They have specially adapted hind- and middle legs for speedy swimming and they also have two sets of eyes: one set for watching out for prey below, the other set for watching out for predators above. Their front legs are held in front of the body to grab possible prey. Other water beetles are Dytiscidae, the true water beetles, which swim under water and only resurface now and then for air.

Figure 6 Leaf litter can be sieved to separate the small beetles form the larger pieces of debris (photo: Menno Schilthuizen).

Figure 5 After sieving, the debris can be searched for small beetles (photo: Marlien Amir).

(g) *rivers*. Water beetles are not so easily found in large and quick-flowing rivers, but the banks of rivers are very good for finding tiger beetles (Cicindelidae), which fly rapidly and are very hard to catch, and ground beetles (Carabidae). Both families are predatory and feed on flies, shrimp, bugs, and other invertebrates at the water's edge.

Figure 7 Ponds, streams and lakes can be sampled for water beetles with a strong water-net (photo: Menno Schilthuizen).

Preservation

Beetles are best killed in a soft plastic jar with a bottom layer of plaster of Paris, some tissue paper and a few drops of ethyl acetate. The plaster will soak up the ethyl acetate, but some of it evaporates every time the jar is opened, so keep a bottle of it with you to refill the killing jar now and then. After a field trip, a killing jar with beetles can be best stored in the freezer until it is time to mount the beetles.

In general, small beetles (< 2 cm) are glued on a strip of cardboard. This is done as follows: place the specimen on its back and spread out all legs and antennae using a brush or a pin. Choose a piece of cardboard of the correct size and put a small drop of thick insect glue on the cardboard. Then, press the cardboard with the glued side down, onto the beetle (which is still on its back). Rearrange the specimen while the glue is still wet. Then, stick a thick insect pin (no. 3 or 4) through the end of the cardboard.

Larger beetles (> 2 cm) are usually pinned with an insect pin. Place the beetle on its back on a thick (3 cm) layer of styrofoam and spread out all legs and antennae. Then turn it on its belly and stick an insect pin (no.2 for beetles of c. 2 cm, no. 3 or higher for larger ones) through the right-hand elytron, under a right angle. Leave c. 1 cm of the pin sticking out above the beetle. Then leave the specimen to dry, either in an airconditioned room or in an oven set to 45 degrees Celsius.

When the glue or the pinned specimen is dry, put a small label on the pin, stating the locality where it was found, for example:

Malaysia: Sabah:
Gunung Alab (30 km ESE
of Kota Kinabalu), 1375 m alt.
5°47.079'N, 116°20.492'E
13.ix.2000, on dead wood
leg. M. Schilthuizen

Then, the specimens can be preserved in an insect box.

Special Collecting Methods

Most beetles are harmless and can be collected by hand. Some of the larger beetles have powerful jaws, so best hold them with thumb and index finger at each shoulder, so their mouth cannot reach you. A few species give off a red or brown smelly liquid, which leaves stains on the fingers. This is a defense against bird and mammal predators, but it is usually not very harmful to human skin. When collecting beetles from dung or other unpleasant places, better use a forceps. Many beetles, for example leaf beetles, tiger beetles, and jewel beetles, will fly when approached, so a butterfly net is a necessity.

Figure 8 Pitfall traps for beetles. The traps are covered with a punctured lid and filled with preservative. A bait is suspended from the lid. Then, they are placed in the forest and regularly checked. (Photos: Menno Schilthuizen)

It often helps to make beetle traps. For example, jars dug into the ground, with the edge level to the ground surface, and left for one or more days, will collect many ground beetles which are active at night, fall into the trap and cannot get out anymore. A similar trap, but supplied with a bit of meat, will attract large dung and carrion beetles. If fruit is used instead of meat, fruit-eating beetles like the beautiful Cetoniidae may be caught.

When you go out collecting at night, you will find many species which are hard to find during the day. Ground beetles are very common on the forest floor and on tree trunks, and so are many darkling beetles (Tenebrionidae). Many beetles that are active by night are also attracted to strong light, such as street lamps. A good way to catch many species of beetle in a short time is to sit for a few hours by a strong, white light in front of a white wall or sheet.

Quick Guide for Identification

Figure 9 Tiger beetle (Cicindelinae) from Gunung Trus Madi (photo: Peter Koomen).

Ground Beetles or Carabidae. 2 - 80 mm. In trees, on the ground, and at the banks of rivers and streams. Body flat, colour mostly dark or metallic. They run and fly quickly. Mostly predators, active at night.

Dive Beetles or Dytiscidae. 2-20 mm. In freshwater. Body oval and flat, colour mostly dark grey or black. They swim under water, surfacing now and then to take up air between their elytra. Mostly predators, active by day.

Whirligigs or Gyrinidae. 5-10 mm. On freshwater. Body oval and flat, colour mostly dark grey or black. They circle on the surface of standing or running freshwater, often in large groups. Predators, active by day.

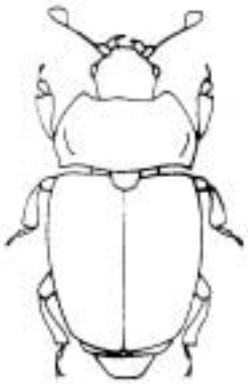

Figure 11 Nitidulidae (drawing: Menno Schilthuizen).

Ambrosius Beetles or Nitidulidae. 2-10 mm. Often in fallen fruits. Body flat, colour mostly reddish brown with or without lighter spots. Slow-moving. Saprophages, active day and night.

Figure 10 Dung beetles (right: Gymnopleurus rolling a ball of dung; drawing and photo: Menno Schilthuizen).

Dung beetles or Scarabaeidae. 5-35 mm. On dung and dead animals. Body solid, round, often with horns, mostly black or metallically coloured. Slow moving, but good at flying. Many species active by day.

Figure 12 Staphylinidae (drawing: Menno Schilthuizen)

Rove Beetles or Staphylinidae. 1-20 mm. In all kinds of habitats, except the canopy. Body long and narrow with very short elytra, mostly dark coloured. Quick moving, some species active by day, others by night. Mostly predators.

Jewel Beetles or Buprestidae. 10-60 mm. Mostly in (disturbed) forests, in clearings and forest edges, on dead wood. Body slender but solid, mostly brightly metallic. They fly away very quickly so they are hard to catch. Active by day. The larvae live in dead wood, the adults often feed on flowers.

Click Beetles or Elateridae. 5-40 mm. Common in all kinds of habitats. Body shape similar to jewel beetles (with which they are related), but usually more slender. When placed on their backs, they will jump into the air with an audible click and often land on their feet again. The click is caused by a pin on the thorax that is suddenly springs out of a socket. Some species active by day, others by night. The larvae live in dead wood or at the roots of living plants.

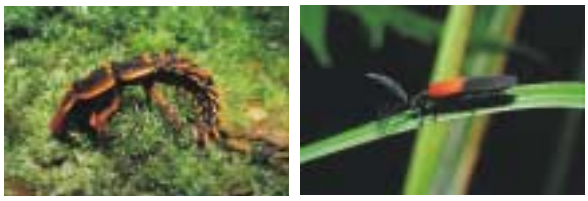

Figure 13 Female (left) and male (right) Duliticola trilobite beetle from Gunung Trus Madi (photos: Peter Koomen).

Net-winged Beetles or Lycidae. 5-60 mm. In forests and gardens. Body flat and soft, often black with red. Females often have a very different shape from the males: they are large and have no wings: they look similar to the larvae! Larvae and females are often called “trilobite larvae” and are commonly seen in montane forests. Males are actively flying by day. Larvae are predators, and adults eat both wood and other insects.

Figure 14 A coccinellid species from Gunung Trus Madi (photo: Peter Koomen).

Ladybird Beetles or Coccinellidae. 2-10 mm. On plants. Body round and ball-shaped, often black with red dots or red with black dots. Most species are predators and eat smaller insects. Some species are herbivores. Active by day.

Fungus Beetles or Endomychidae. 5-20 mm. On mushrooms and other fungi. Body shape similar to Ladybird Beetles (with which they are related), but a bit flatter. Usually black with red dots or red with black dots. Both adults and larvae eat mushrooms. They are active by night and day.

Figure 15 A cerambycid from Gunung Kinabalu (photo: Menno Schilthuizen).

Pleasing Fungus Beetles or Erotylidae. 3-30 mm. On fungi on dead trees. Usually black-with-red, long-oval, shiny and solid beetles. Both adults and larvae feed on fungi. They are particularly active by night.

Longhorn Beetles or Cerambycidae. 10-100 mm. On trees and dead wood. Usually slender, with long or very long antennae. Often beautifully coloured. Adults feed on plant sap and pollen, larvae mostly on dead or living wood. Most species active by day, many also by night.

Leaf Beetles or Chrysomelidae. 2-20 mm. On living herbs, larger plants, and trees. Usually soft-bodied, metallic with red or yellow. Antennae quite long. Larvae and adults feed on leaves. Active by day.

Figure 17 Dorcus parallelipipedus, a European stag beetle (photo: Menno Schilthuizen).

Stag Beetles or Lucanidae. 10-100 mm. On dead wood. Large, solid beetles, mostly black or black with yellow. In the males, the front jaws often very large. They are used for fights between males. Larvae live in dead wood. Adults live on sap and pollen. Most species active by day, some also by night.

Figure 16 Two European weevils mating (photo: Menno Schilthuizen).

Weevils or Curculionidae. 2-60 mm. On living and dead plants and trees. The head is extended into a snout, which can be longer than the rest of the body in some species. The body mostly hard and heavy, often ball-shaped. Many species cannot fly. Both larvae and adults are herbivores on living plants or dead wood. Mostly active by day.