

Macrofauna – Ground- and litter-dwelling macrofauna

Introduction

The soil surface and leaf litter are important components of soil and may represent a perfect habitat. In particular, leaf litter, made up of dead plant material, such as leaves, bark, needles and twigs, that has fallen to the ground, is very rich in nutrients and keeps the soil moist. It also offers the perfect conditions in which to build nests: hiding places and protected spots. Many of the organisms inhabiting the ground and the litter fall within the group of soil macrofauna (animals that are at least one centimetre long). Macrofauna include myriapods, beetles, insect larvae, slugs, snails, spiders and scorpions (see pages 57, 59–60). Some of these organisms spend their entire lives on the soil surface and in leaf litter, while others are found only there at certain points in their lives. These organisms may have a high ecological importance (e.g. as decomposers of litter). In these pages, we focus on the Arachnida (e.g. spiders and scorpions), Gastropoda (e.g. snails and slugs) and some Hymenoptera (e.g. mining bees). [72, 73]



⋯ (a) The Goliath birdeater, *Theraphosa blondi*, the world's largest spider. (b) A specimen of *Habronattus amicus* feeding on a bristletail. (c) A trapdoor spider, *Bothriocyrtum californicum*. (d) *Homalonychus theologus* has bristles that serve to gather sand/soil particles, thus providing a natural camouflage. (SM, MH)

Arachnida

The class Arachnida are arthropods. Their eight legs that distinguish them from insects, which have six legs. The most well-known groups of arachnids are spiders (order Araneae) and scorpions (order Scorpiones). Spiders come in a large range of sizes, from less than 1 mm up to 30 cm, such as the Goliath birdeater (*Theraphosa blondi*), a spider belonging to the tarantula family. Scorpions range in size from 9 mm up to specimens such as the Mexican cave-dwelling *Typhlochactas mitchelli* that can reach up to 20 cm. Spiders' bodies consist of two sections (tagmata): the cephalothorax or prosoma at the front, and the abdomen or opisthosoma at the back. Spiders have a pair of cephalic appendages in front of the mouth (chelicerae), which they use to inject venom into prey from venom glands. Scorpions' bodies are also divided into two regions: the head (cephalothorax), the abdomen (opisthosoma), which is subdivided into mesosoma (seven segments) and the metasoma or tail (five segments plus a sixth, the telson, bearing the sting). The sting consists of the vesicle, which holds a pair of venom glands, and the aculeus, the venom-injecting barb. Spiders make up a very large group of organisms comprising more than 40 000 species. About 1 700 species of scorpion have been recorded to date. Spiders and scorpions are found on all major land masses, except Antarctica. Both groups are predators. They mostly prey on insects, although a few large species can also take lizards, birds and small mammals. An exception is represented by the herbivorous spider species *Bagheera kiplingi*. Soil is often used as their hunting ground, in which they use different methods of capturing prey. One of the most clever strategies is adopted by the ambush 'trapdoor spiders' (family Ctenizidae); they burrow holes into the soil, often closed by trapdoors and surrounded by networks of silk threads that alert these spiders to the presence of prey. Scorpions are nocturnal hunters, remaining in underground holes or under rocks during the day. Scorpions can survive long periods of food deprivation thanks to a specific food-storage organ and slow digestion process; some are able to survive 6–12 months of starvation.



⋯ (a) The scorpion *Vaejovis carolinensis* showing its sting and chelate pedipalps. (b) A scorpion feeding on its prey using its chelicerae. (c) Before the first moult, a scorpion's brood cannot survive without the mother, since they depend on her for protection and to regulate their moisture levels. (MH, TIW, FK)

Gastropoda

Snails and slugs are the two most relevant groups of gastropods related to soil. Taxonomically, they are both included in the order Pulmonata. The clear difference between them is the presence of a conspicuous shell in snails, which is very reduced, totally absent or internal in slugs. A snail's shell is made of calcium carbonate and has the typical spiral shape. Both snails and slugs range greatly in size; the largest species can reach 30 cm. Around 25 000 snail species are present worldwide, whereas only approximately 5 000 slug species exist. Terrestrial snails are usually herbivorous; however, some species are carnivores. Most slugs feed on a broad spectrum of organic materials, including leaves from living plants, lichens (see page 42), fungi (see pages 38–41) and even carrion. Some slugs are predators and eat other slugs and snails or earthworms (see page 58). Some snail and slug species can cause damage to agricultural crops and garden plants and are, therefore, often considered as pests.



⋯ (a) A banana (*Ariolimax californicus*) slug. This nickname is due to the colouration. (c) Two snails (*Helix* spp.) feeding on a mushroom. The spiral shell is their distinctive feature. (BLO, SJE)

Burrowing or mining bees

- Not all bees (Arthropoda, Ectognatha, Hymenoptera) live in hives like honey bees do and, in fact, five of the seven recognised families of bees are ground-nesting bees (approximately 70 % of the 20 000 known bee species). Their burrows can reach 60 cm in depth and the entrance is often marked by a small mound of excavated soil. Depending on the species, the female fills the brood cells at the end of the branched burrow with pollen, honey or a mixture of nectar and pollen and, once the clump reaches the right size (sometimes after a good number of trips to flowers), she lays an egg on each one. The larva hatches within a few days, grows quickly and pupates within a few weeks. The adults emerge the following spring after hibernation.
- Unlike social bees and wasps, ground-nesting bees do not live in colonies, although some species could nest in large groups ('gregarious nesters') and become so visible, especially in lawns and paths, that gardeners consider them as pests. However, in reasonable numbers they will not harm your garden. They are not aggressive insects even though the females do have stings.
- These solitary bees (specifically *Colletes* and *Andrena*, two common widespread genera) are good pollinators of economically important plants. They are often 'oligolectic', meaning that they collect pollen from only a select few plant species, and if that plant becomes rare or extinct, so does its pollinator.



⋯ A bee emerging from its nest in the soil. (JB)