



The most abundant soil dwelling microarthropods are springtails and mites.

## Springtails (Collembola)

Springtails are primitive, wingless microarthropods, closely related to insects <sup>(1)</sup>. They're among the oldest of terrestrial animals, with a 400 million year old Collembola fossil discovered in Scotland.

The name 'springtail' derives from a lever-like hinged spring, the furcula, located on the underside of their abdomen. This appendage is held under tension, and once released, snaps against the ground propelling the springtail up to several times its own body length. In the tiny, dark air spaces between soil particles such an adaptation is of limited use, so many soil dwelling species have a reduced (or absent) furcula.

Similarly, you may see black, light-sensitive pigment spots on the heads of some springtails, but not on those that dwell deep in soil or in caves.

All springtails possess six legs and a pair of antennae, and they tend to fall into one of three body types: a bulbous, rounded form; an elongate form with pronounced furcula; and an elongate, soil dwelling form, with reduced antennae and furcula.

Springtails are found throughout the world from the Antarctic to the Himalayas with new species still being discovered. Over 7800 species are currently listed worldwide, with about two thousand species in Australia <sup>(1)</sup>.

Their habitats range from the soil to leaf litter, bark to caves and even the surface of stagnant ponds. Most species feed on decaying plant material (detritivores), although some consume fungi, alga and lichens and occasionally dead animal matter. Only a few springtail species are pests, such as the introduced Lucerne 'flea' that can damage Australian crops. In turn, springtails are a major food source for a variety of soil predators, including ants, mites and pseudoscorpions.

Springtail numbers tend to be highest where there's a combination of warmth, moisture and high organic matter content. Desiccation is potentially lethal since most springtails respire directly through a porous cuticle.

A single habitat may support 20 or more species <sup>(2)</sup>. Under ideal conditions populations can increase considerably, forming large aggregations. Population densities in the soil and litter have been measured at over 500 000 springtails/m<sup>2</sup> although in Australia densities tend to range from 2000 to 30 000 springtails/m<sup>2</sup> <sup>(1)</sup>.

Larvae and a succession of immature stages closely resemble the adults, with individuals moulting as they increase in body size. Adult springtails continue to moult, although with minimal changes in size. Some species may moult up to 50 times over their life span.

Large springtails are visible to the naked eye, and most species fall in the range of 0.2 to 3 mm (one or two are even larger, such as a Central European species that reaches 9 mm in length). To help students estimate the insect's size, try placing a pin underneath the dissecting microscope for comparison.

## Mites (Acari)

Mites, like spiders, belong to the class Arachnida, and at first glance, both are visually similar. However, mites are distinguished from spiders by their lack of a waist between the thorax (where their legs are attached) and abdomen. This characteristic gives the appearance of a single oval body.

A typical life cycle of a mite includes egg, larva, nymph (protonymph, deuteronymph, tritonymph) and adult, although there's often variation between species. Individuals possess eight legs in their adult and nymph stages, but only six as larvae. As for springtails, they've been around for a long time, with fossils dating back nearly 400 million years <sup>(3)</sup>.

Mites don't possess antennae and have no recognizable head, although their front end should have visible pincer-like mouthparts. Most measure less than 1 mm, although with a size range of 0.1-3 mm some species are just visible to the naked eye. Certain species appear hairy, and come in a wide range of colours.

The Acari is a very diverse order, that includes parasitic species as well as free-living, and they've colonised nearly every known terrestrial, marine and freshwater habitat. Most terrestrial mites live in the soil and leaf litter, although some are also found in plants, mosses and lichens. They include some major economic pests such as spider mites.

About 48 000 species of mite have so far been described, but this is likely to be a fraction of all species <sup>(4)</sup>. In all but the driest of environments there can be 100 000's of mites/m<sup>2</sup> of soil <sup>(5)</sup>.

Soil mites include slow-moving species feeding on microbes and detritus, as well as fast, long-legged predators that hunt small invertebrates such as springtails, other mites and nematodes. Like spiders, predatory mites can inject a digestive liquid into their prey.

All these species help to regulate microbial activity, and their grazing has even been shown to stimulate microbial activity, just as sheep grazing on grass stimulates new pasture growth <sup>(6)</sup>. Experiments that have removed mites from a substrate demonstrated that the organic matter decomposition rate slows by an average of 23% <sup>(6)</sup>.

## References

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