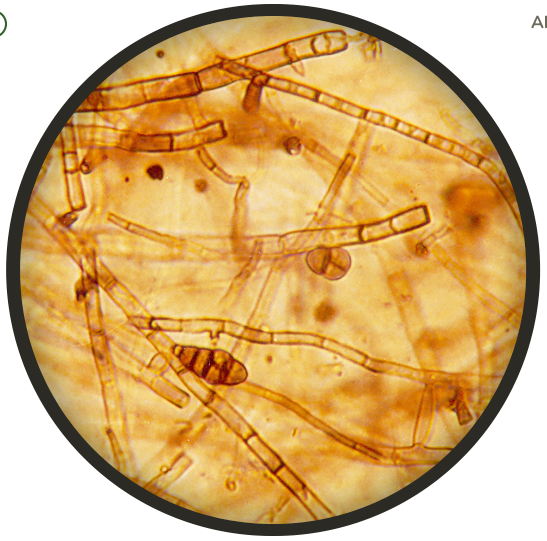
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FUNGI

About 400x



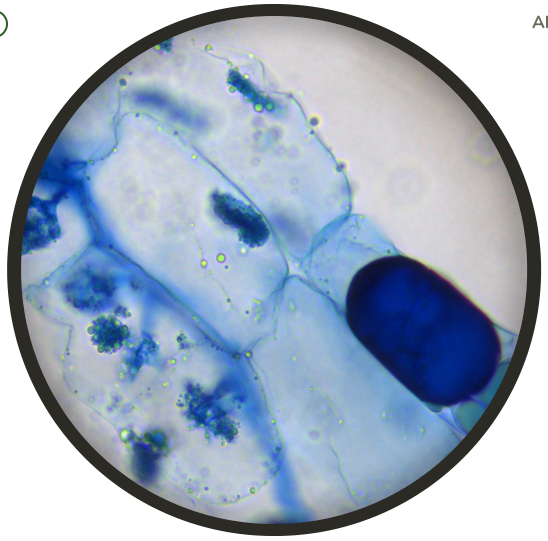
Fungal Hyphae

with septa (cross-walls)

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FUNGI

About 400x



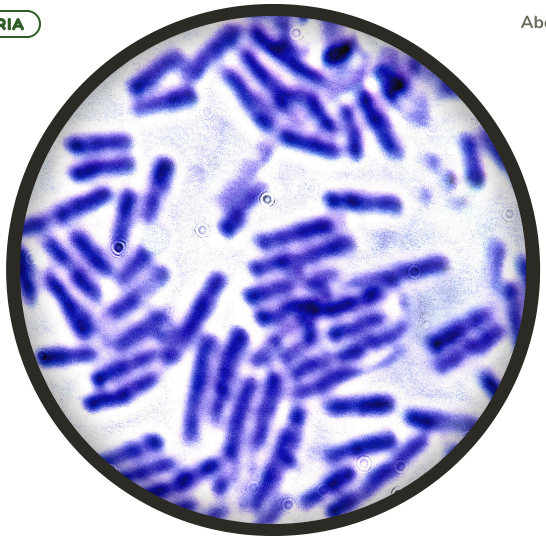
Mycorrhizal Fungi

living inside a plant root

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BACTERIA

About 1000x



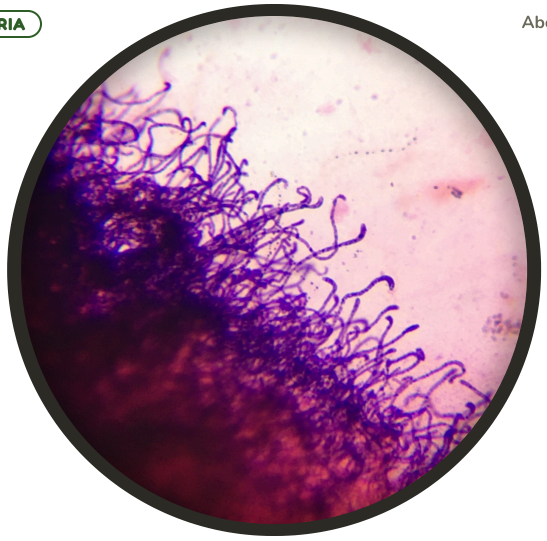
Bacteria

rod-shaped soil bacteria

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BACTERIA

About 1000x



Actinomycetes

thread-forming soil bacteria

Mycorrhizal Fungi

FUNGI

What you're seeing

A plant root stained blue. The fungus grows right inside the root cells. The dark oval is a vesicle, where the fungus stores food, and the speckled clumps are where it trades with the plant.

Its job in the soil

- Partners with about 8 out of 10 plants on Earth.
- Trades water, phosphorus and other minerals to the plant in exchange for sugar.
- Stretches far past the roots, like adding thousands of extra root hairs.
- Helps plants handle drought and stress.

Look for

Heavy chemical fertilizer, tilling and long bare periods can shrink these partners. Living roots and mulch keep them strong.

Photo: Rajarshi Rit, CC BY 4.0, via Wikimedia Commons

Fungal Hyphae

FUNGI

What you're seeing

Threads of a common soil fungus. The thin lines across each thread are septa, walls that divide the thread into small rooms. The dark, brick-patterned shape is one of its spores.

Its job in the soil

- Breaks down tough leaves, straw and wood that bacteria can't handle alone.
- Spreads through soil like an underground web, reaching water and nutrients roots can't.
- Glues soil into crumbs, so air and water can move through.
- Holds nutrients in its body so rain doesn't wash them away.

Look for

Septa are a clue that you are looking at a true fungus. Threads with no cross-walls can be water molds, like the ones that cause root rot.

Photo: Tashkoskip, CC BY-SA 4.0, via Wikimedia Commons

Actinomycetes

BACTERIA

What you're seeing

Actinomycetes are bacteria that grow in fine branching threads, a bit like a tiny fungus. These are stained purple at the edge of a colony.

Its job in the soil

- Give healthy soil its sweet, earthy smell after rain.
- Break down tough stuff like bark, chitin and older compost.
- Make natural compounds that help keep disease-causing microbes in check.
- Thrive in finished compost and well-aerated soil.

Look for

Their threads are much thinner than fungal hyphae. That earthy smell in your compost means they are hard at work.

Photo: James kunn, CC BY 4.0, via Wikimedia Commons

Bacteria

BACTERIA

What you're seeing

Bacillus, one of the most common soil bacteria, stained purple so it shows up. Each little rod is one whole living cell.

Its job in the soil

- The most numerous life in soil. One teaspoon can hold hundreds of millions.
- Break down simple foods like fresh leaves, root sugars and manure.
- Hold nitrogen and other nutrients in their bodies so rain can't wash them away.
- Make sticky glue that turns dust into crumbly soil.

Look for

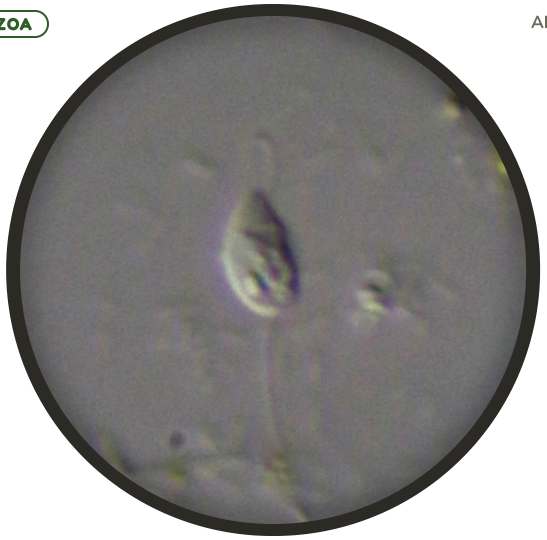
Some, like Bacillus, form tough spores that wait out dry spells, then wake up when the soil is moist again.

Photo: Dr Graham Beards, CC BY-SA 4.0, via Wikimedia Commons

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PROTOZOA

About 400x



Flagellates

tiny whip-tailed protozoa

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PROTOZOA

About 400x



Ciliates

hair-covered protozoa

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NEMATODES

About 100x



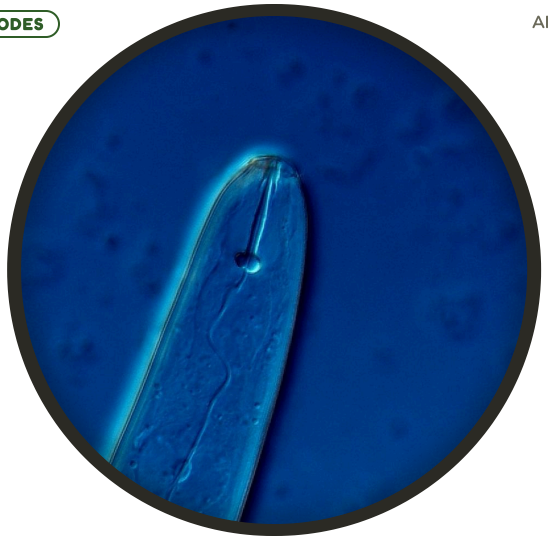
Bacterial-Feeding Nematode

a helpful soil worm

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NEMATODES

About 400x



Root-Feeding Nematode

the one to watch

Ciliates

PROTOZOA

What you're seeing

Colpoda, a bean-shaped ciliate common in soil. Its body is covered in tiny hairs called cilia that beat like oars.

Its job in the soil

- Eat bacteria and release nutrients plants can use.
- Larger and faster than flagellates.
- Can curl up in a protective cyst and wait for wetter times.

Look for

A few ciliates are normal. Large numbers can mean the soil is short on air, like soggy or compacted ground.

Photo: Picturepest, CC BY 2.0, via Wikimedia Commons

Flagellates

PROTOZOA

What you're seeing

Bodo, a single-celled flagellate. The thin line trailing from its body is a flagellum, a whip it uses to swim and to sweep bacteria toward its mouth.

Its job in the soil

- Eat bacteria, thousands every day.
- Release the extra nitrogen from that meal right beside the roots, as plant food.
- Keep bacteria populations in balance.
- Among the smallest hunters in the soil.

Look for

Look for a small oval that darts and jerks across the slide. Lots of flagellates means plenty of bacteria to feed on.

Photo: Picturepest, CC BY 2.0, via Wikimedia Commons

Root-Feeding Nematode

NEMATODES

What you're seeing

The head of a lesion nematode. The needle in its mouth is a stylet, a hollow spear it pushes into roots to suck out plant juices.

Its job in the soil

- Pierces roots and feeds on plant cells.
- Leaves wounds where root-rot fungi and bacteria can get in.
- Too many can stunt plants, yellow leaves and shrink harvests.
- Kept in check by predatory nematodes, fungi and a balanced soil.

Look for

A sharp spear in the mouth. A few are normal; a lot means the soil needs more of the good guys.

Photo: Walter Peraza Padilla, National University of Costa Rica, Bugwood.org, CC BY 3.0 US, via Wikimedia Commons

Bacterial-Feeding Nematode

NEMATODES

What you're seeing

Tiny round worms that feed on bacteria. You can see the digestive tube running the length of each body. Most soil nematodes are helpers like these.

Its job in the soil

- Eat bacteria and release nitrogen as plant food near the roots.
- Carry helpful bacteria to new spots as they move.
- Become food for fungi, mites and other soil life.
- A healthy number is a sign of a lively soil food web.

Look for

An open, tube-like mouth with no spear. That's how you tell a helper from a root feeder.

Photo: kdfj, CC BY-SA 3.0, via Wikimedia Commons