# Soil Biodiversity – who is there and what do they do?

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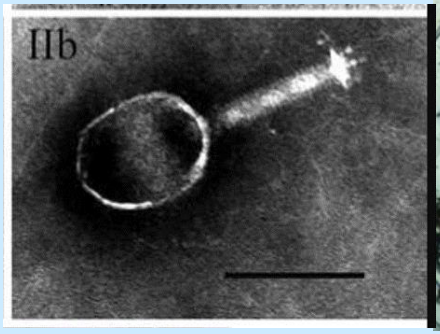
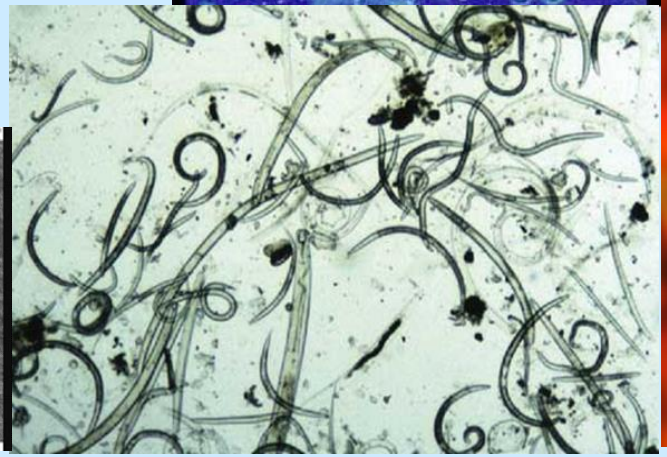
# Human vs. Root microbiome

Soil biodiversity is the ground underneath us:

- Self-existing
- Responsive
- Alive

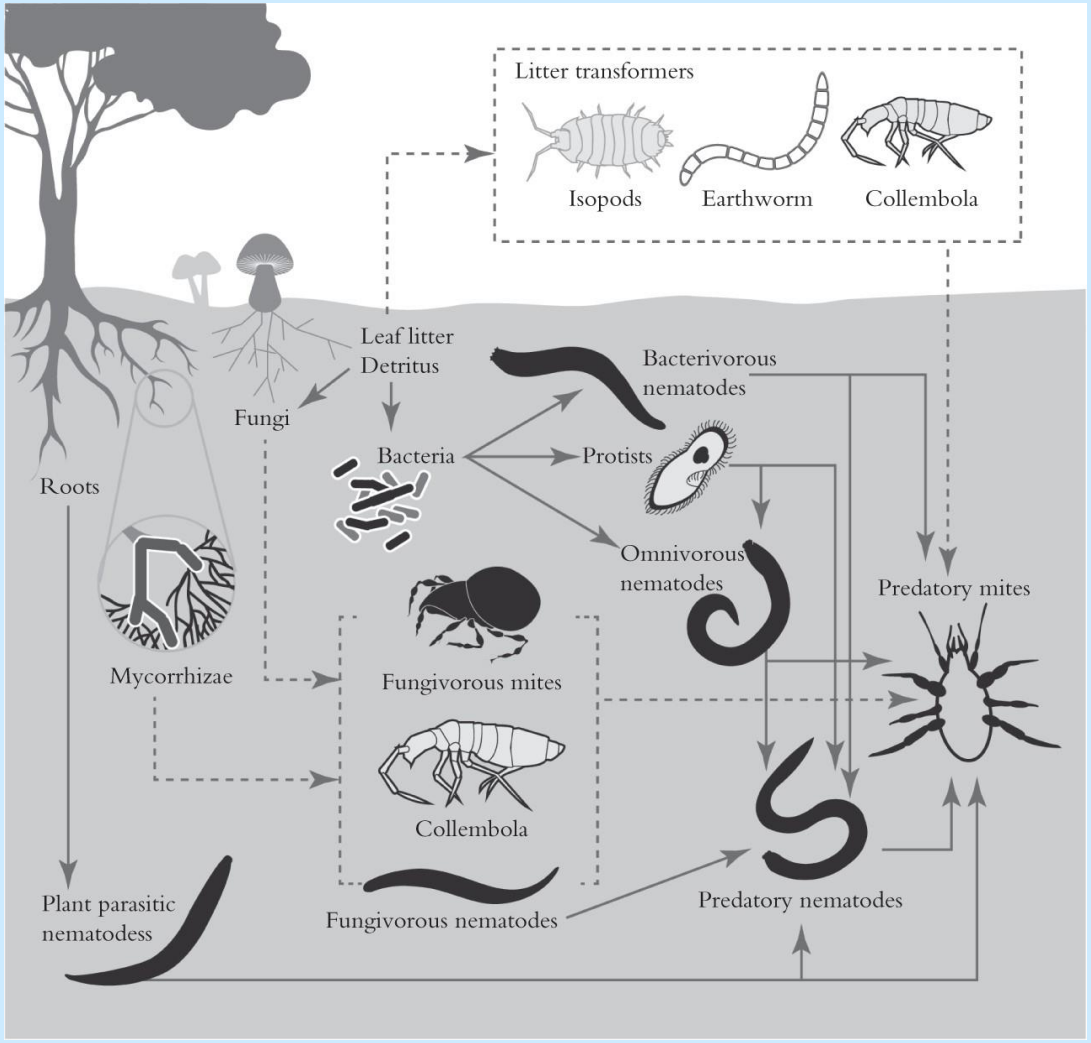


# World Soil Day 2023: "Soils: where food begins"

Soil Health = synergy of agronomic and ecological functioning.

Relationships create ecosystem processes like carbon and nutrient cycling.




Nielsen, U. (2019). Soil and Its Fauna.

# Soil is alive!

In 100- 200 g soil:

| | |
|---|---|
| Bacteria | 50 billion |
| Protozoa | 50 million |
| Fungus | 100million |
| Nematodes | 10,000 |
| Arthropods | 1000 |
| Earthworms | 0 to 2 |

# What does soil biology do?

**Microorganisms**

- Mineralize most C and N
- Binding of soil aggregates
- Detoxification
- Symbionts/disease

**“Larger” Soil Fauna**

- Eat/fragment detritus
- Feces stimulate bacteria and fungi
- Increase soil porosity (burrows)
- Increase aggregate stability (casts)

# Size range of soil organisms

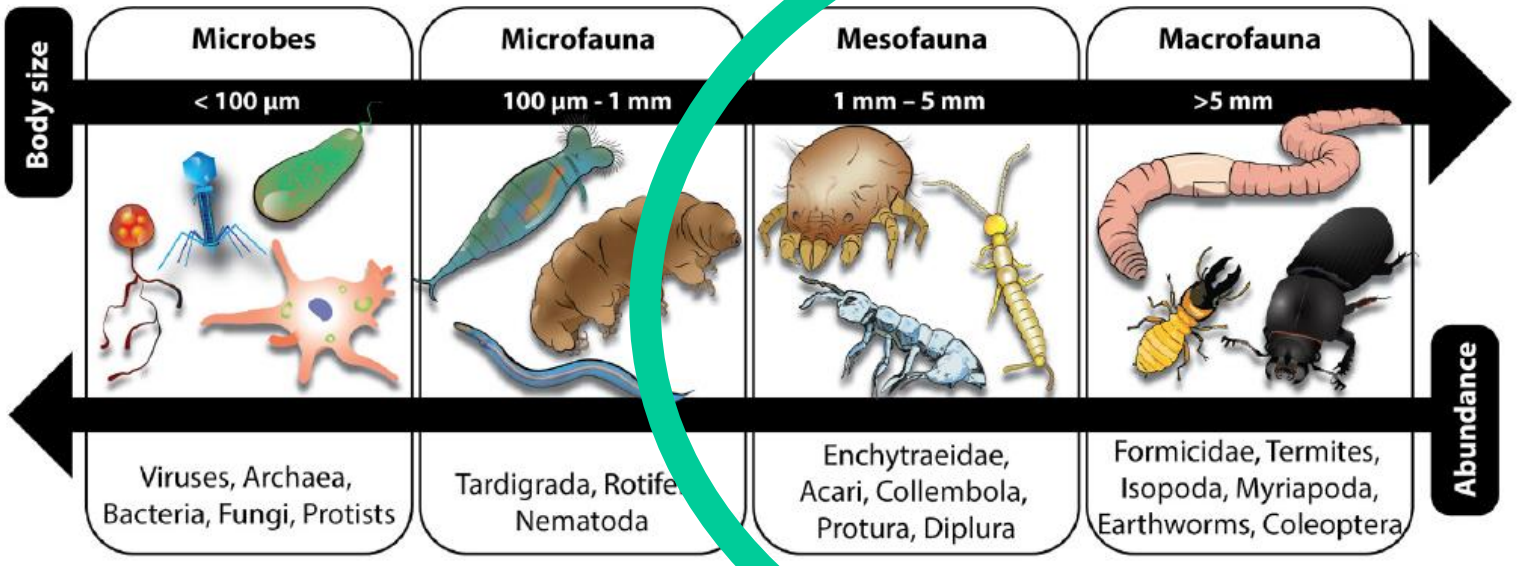
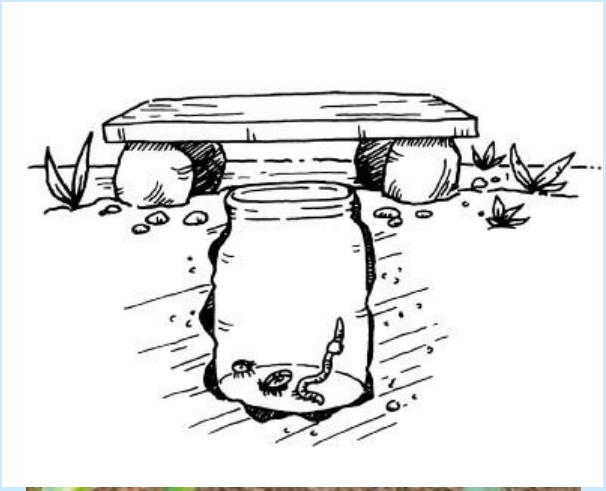



**Figure 2.2.** Size classification of soil organisms. As body size increases, abunda decreases. *Credit: Javier A. Ceja-Navarro. Modified from* Soil *Biodiversity Atlas (Orgiazzi et al. 2016); Credit: B Jakabek, Y Eglit, M Shaw, H Segers, L Galli,* RR Castro Solar, T Tsunoda, S Franzenbura pe, C Abbe. *Full-size DOI: 10.7717/peerj.9271/fig-2.*

# Collecting surface organisms: Pitfall trap

- Sink a container (such as a yogurt cup) into the ground so the rim is level with the soil surface.
- Add 1/2 of an inch of non-hazardous antifreeze to the cup to preserve the creatures and prevent them from eating one another.
- Leave in place for a week and wait for soil organisms to fall into the trap.



# Arthropods

- Large phylum Arthropoda
  - Includes insects, spiders, crustacean
  - Exoskeleton made of chitin
  - Soil arthropods – beetles, rolly pollies, mites, collembola, centipedes, millipedes.

# Millipedes and Isopods

- Shred decomposing plant material into smaller pieces
- Makes more accessible as food to smaller organisms.
- Assist with decomposition and nutrient cycling.

Predatory centipede

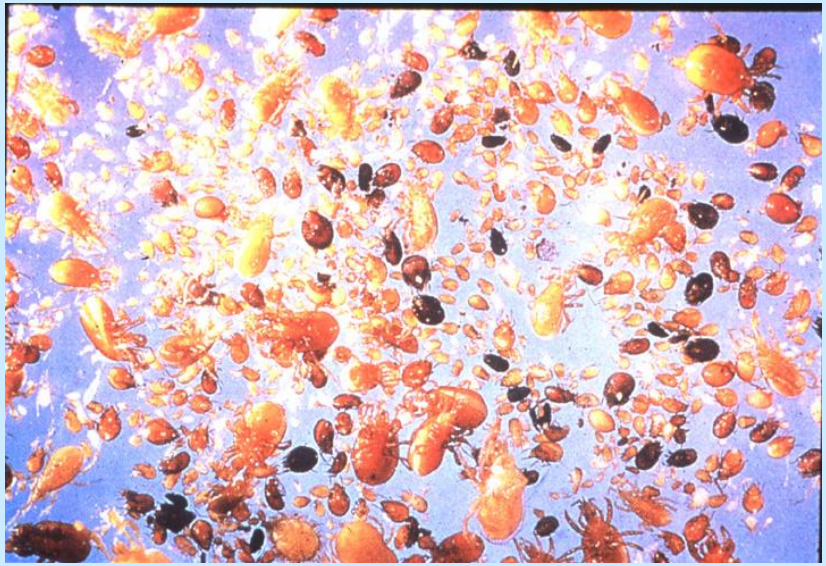
# Beetles

- Family Carabidae – ground beetles
- Reduce pests in agricultural fields.
- Can promote with reduced tillage or grass/vegetation strips

https://eorganic.org/node/33936

# Soil Mites

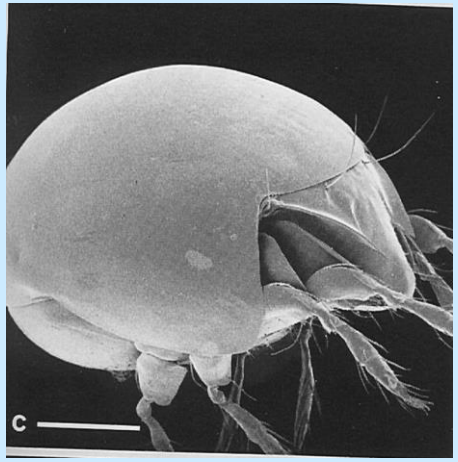
- 200 species of mites in this microscope view.
- Extracted from one square foot of the top two inches of forest litter and soil.
- Poorly studied,  but enormously significant for nutrient release and pest control.



*Val Behan-Pelletier, Agriculture and Agri-Food Canada*

# Soil Mites

- Related to ticks.
- Some prey on nematodes, springtails, other mites, and the larvae of insects.
- Others graze on microbes from root surfaces or dead leaves.


*Gerhard Eisenbeis and Wilfried Wichard. 1987. Atlas on the Biology of Soil Arthropods.* Pergamasus sp.

# Predatory mites

- Front legs modified for grabbing prey.

https://www.chaosofdelight.org/mites

# Oribatida *box mites*

- Most are fungivores and detritivores.
- Heavily armored.
- More common with surface residue.
- Indicate carbon cycling and soil health.

# Springtails - Collembola





www.collebola.org

Furcula

# Collembola

- Ancient relatives of insects.
- Fossils from the Devonian (ca 400 million years ago).
- Ubiquitous in terrestrial systems.
- One of the more successful arthropod lineages.
- Mostly eat fungi.
- aid with nutrient cycling in the soil, helping to form soil microstructure

# Thank you!