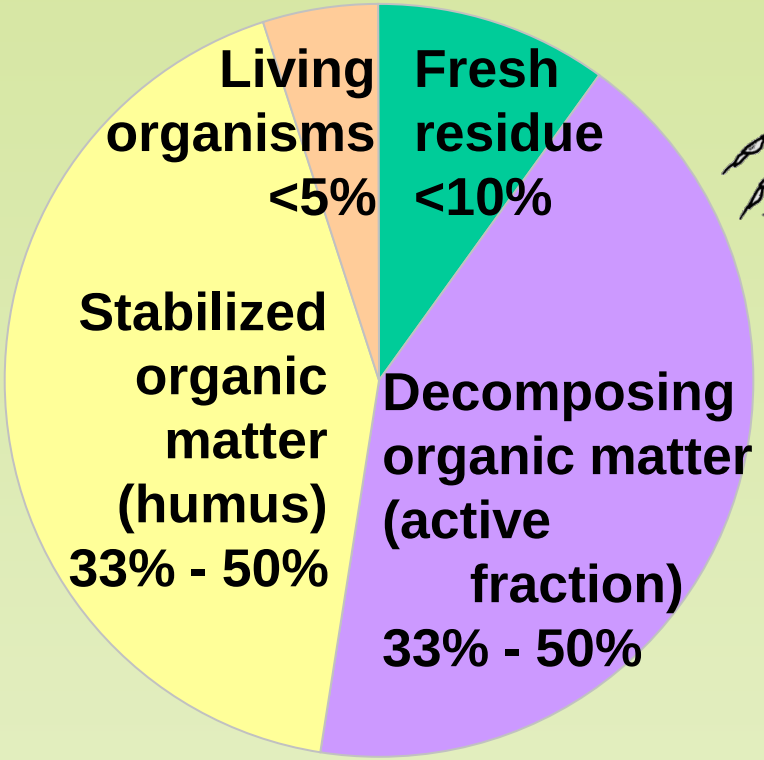
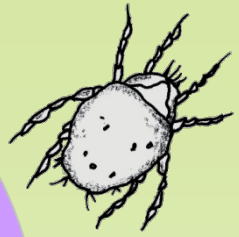
Components of Soil Organic Matter



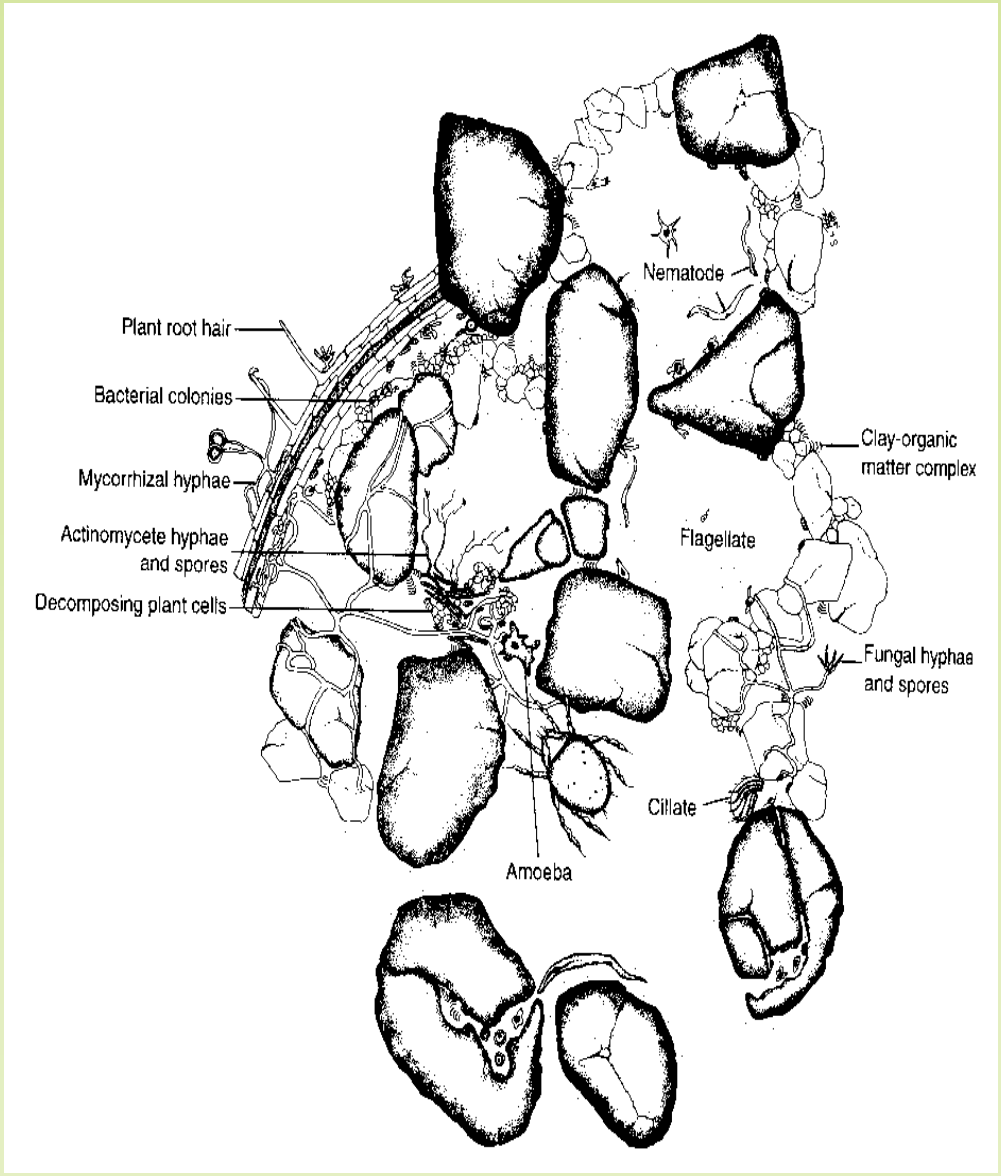


Photos taken from the NRCS Soil Quality website (http://soils.usda.gov/sqi/index.html)

Source: NRCS Soil Biology Primer

Agronomy Tech Note 76 (http://www.nm.nrcs.usda.gov/technical/handbooks/iwm/nmiwm.html)

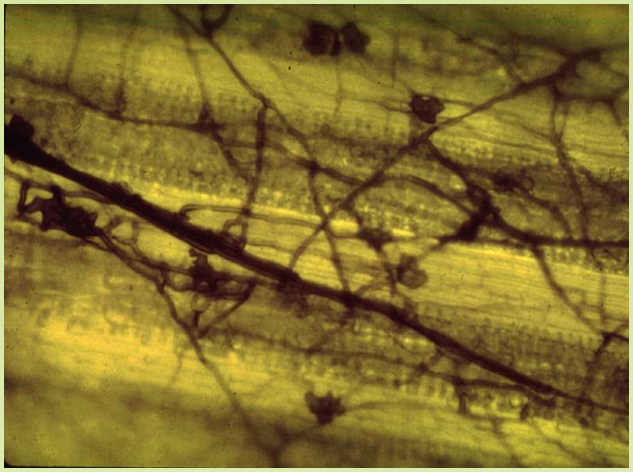
Rhizosphere



Typical Numbers of Soil Organisms in Healthy Ecosystems

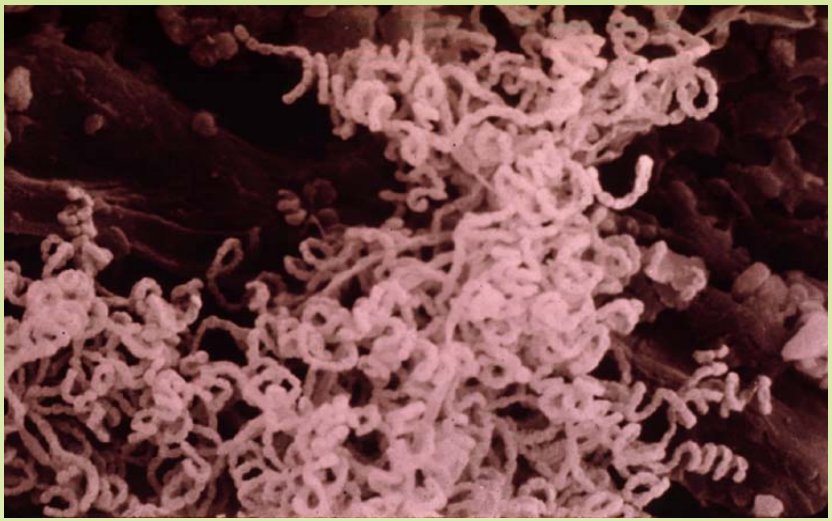
	Ag Land	Prairie	Forest
	Organisms per gram (teaspoon) of soil		
Bacteria	**100 mil. -1 bil.**	**100 mil. -1 bil.**	**100 mil. -1 bil.**
Fungi	**Several yards**	**10s – 100's of yds**	**1-40 miles (in conifers)**
Protozoa	**1000's**	**1000's**	**100,000's**
Nematodes	**10-20**	**10's – 100's**	**100's**
	Organisms per square foot		
Arthropods	**< 100**	**500-2000**	**10,000-25,000**
Earthworms	**5-30**	**10-50**	**10-50 (0 in conifers)**

Fungus beginning to decompose leaf veins in grass clippings

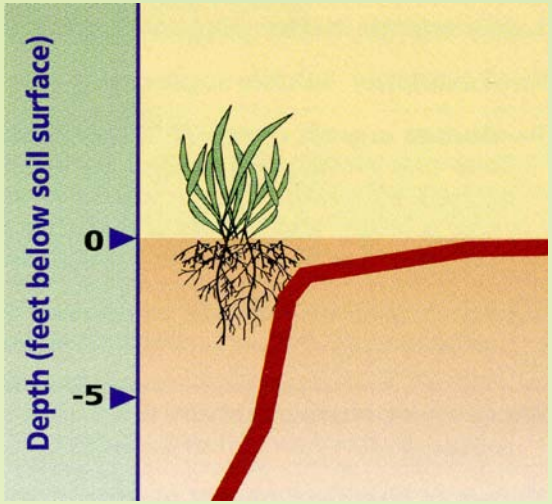


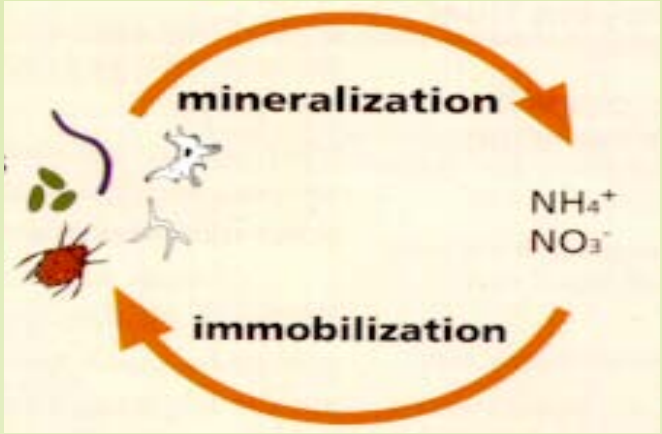
Actinomycetes

(decomposers: Bacterial cells that grow like fungal hyphae; give soil its earthy smell**)**



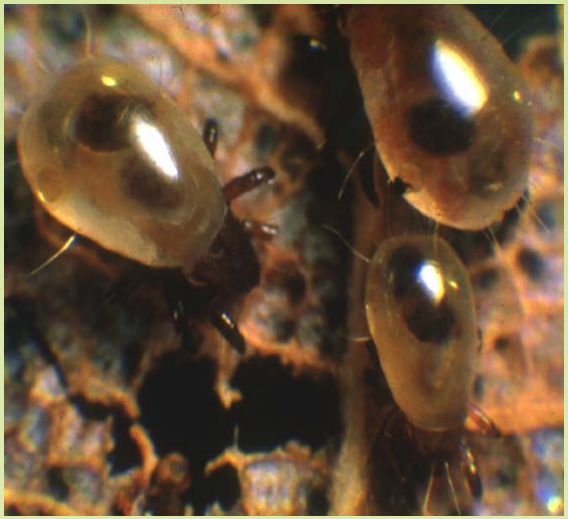
Microbial Biomass
(decreases with depth)





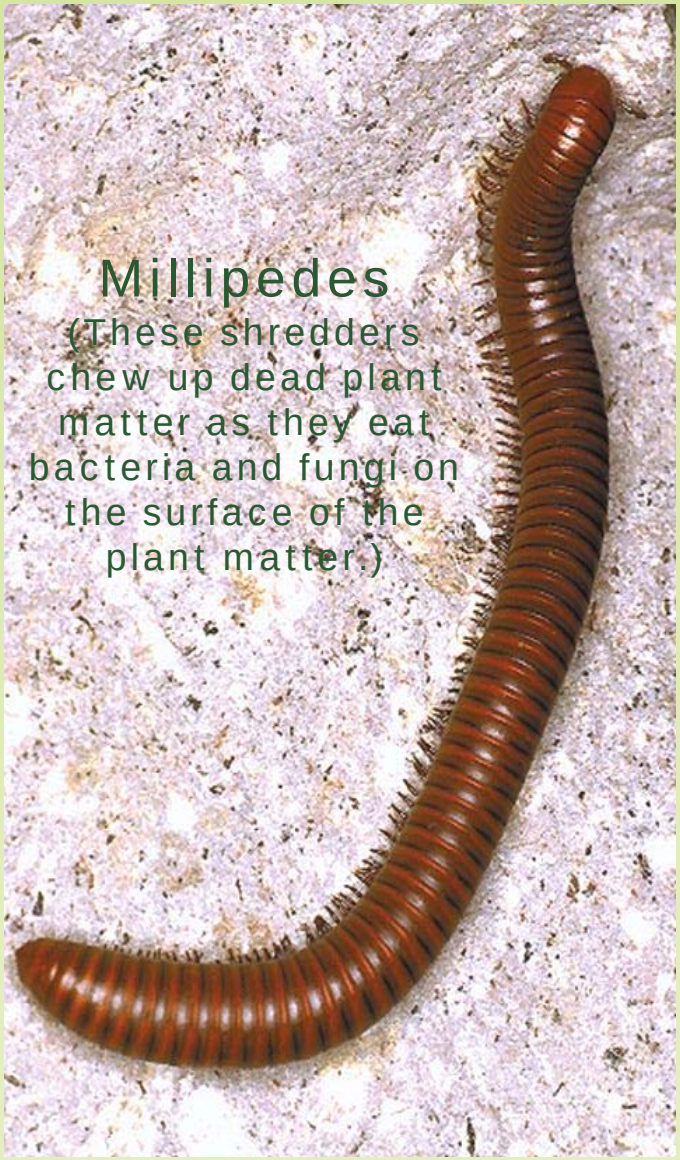
(Organic nutrients are stored in soil organisms and organic matter.)

Oribatid Mites shredding a leaf.



Dung-beetles are common in some pastures where they elaborately bury balls of organic waste and tend to their young underground.

Millipedes
(These shredders chew up dead plant matter as they eat bacteria and fungi on the surface of the plant matter.)

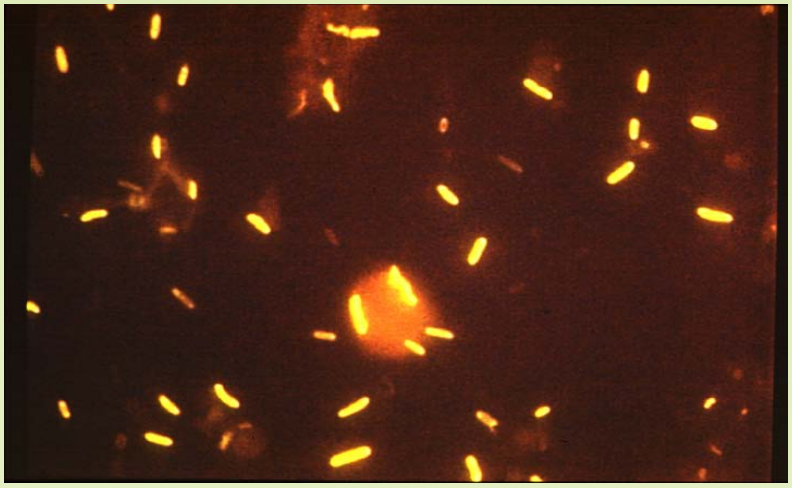


Sowbugs: their powerful mouth-parts are used to fragment plant residue and leaf litter.

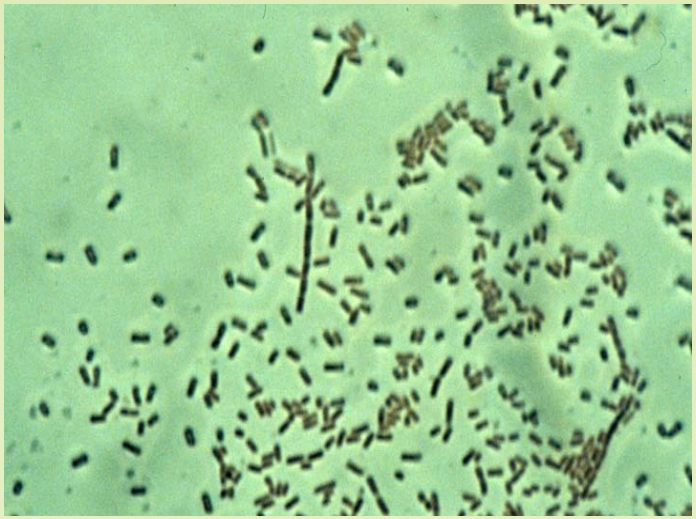
Nitrogen-fixing Bacteria
(nodules formed where Rhizobium bacteria infected soybean roots)

Bacteria dot the surface of strands of fungal hyphae.

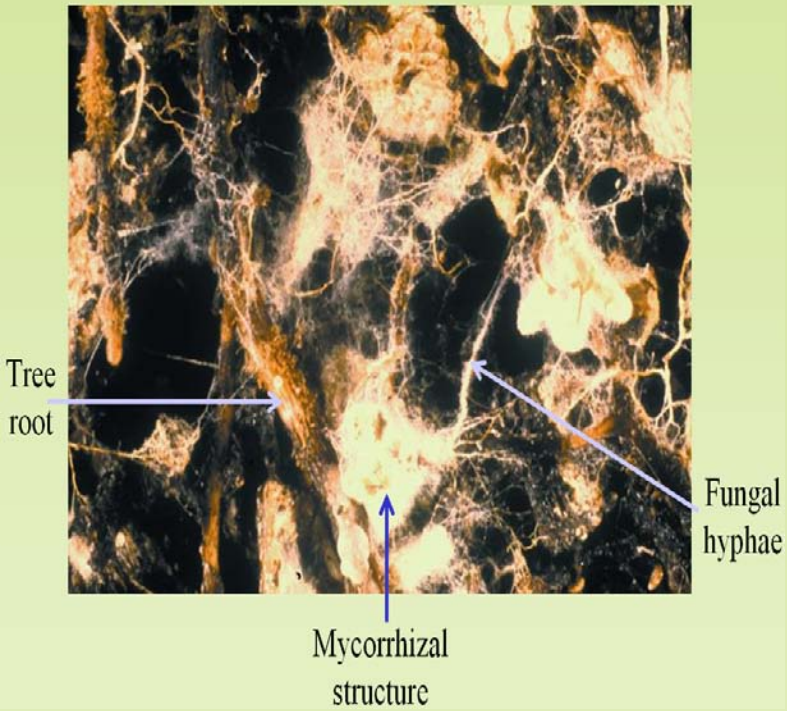
These bacteria have taken up a fluorescent stain, making them easier to count.



A ton of microscopic bacteria may be active in each acre of soil.

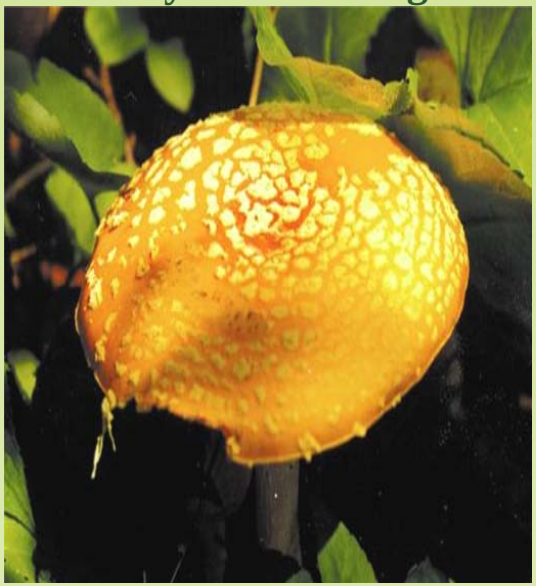


Mycorrhizae



- Retain nutrients in the soil
- Decompose carbon compounds
- Improve OM accumulations
- Bind soil particles
- Food for the rest of the food web
- Mycorrhizal fungi compete with plant pathogens

Mushrooms:The fruiting body of some fungi



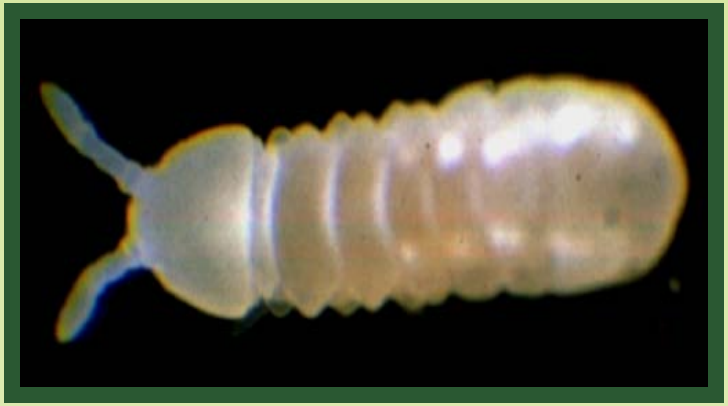
Mycorrhizal Fungi

(They link root cells to soil particles. In this photo, sand grains are bound to a root by hyphae, and by polysaccharides secreted by the plant and the fungi)

Ectomycorrhizae

Springtails (fungal feeders)

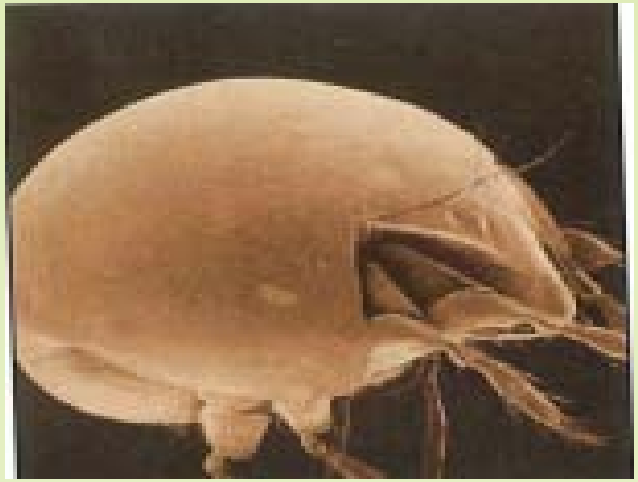
- **Abundant in many soils**
- **Feed on some disease-causing fungi**



Springtails are the most abundant arthropods in many agricultural and rangeland soils.

(Springtails have been shown to be beneficial to crop plants by releasing nutrients and by feeding upon diseases caused by fungi.)

Oribatid turtle-mites are among the most numerous of the micro-arthropods. This millimeter-long species feeds on fungi.



PROTOZOA

(Ciliates, Amoebas & Flagellates are protozoa soil microorganisms)

Ciliate

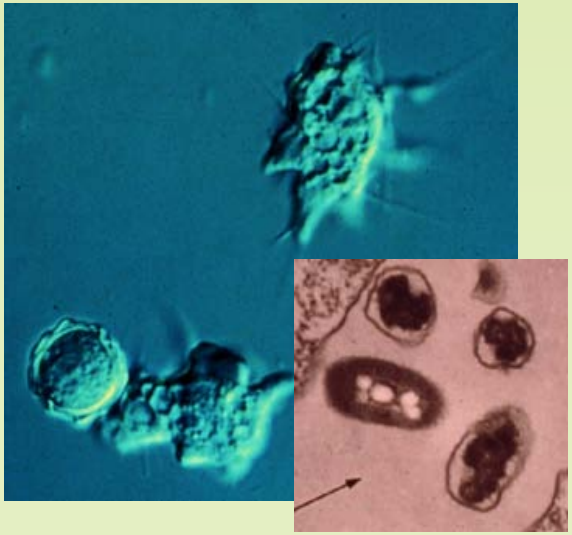
(they eat Amoebas, Flagellates & Bacteria)

Flagellate

(they eat Bacteria)

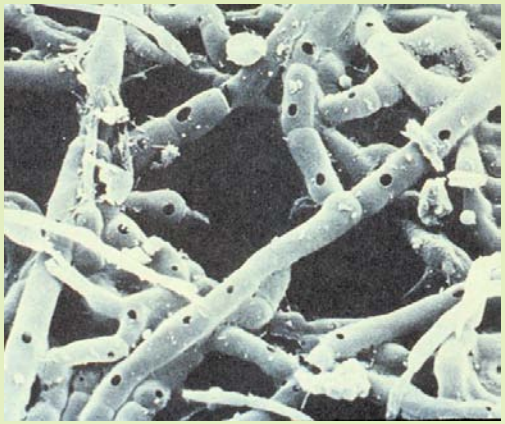
Amoebae

(they eat Flagellates & Bacteria)



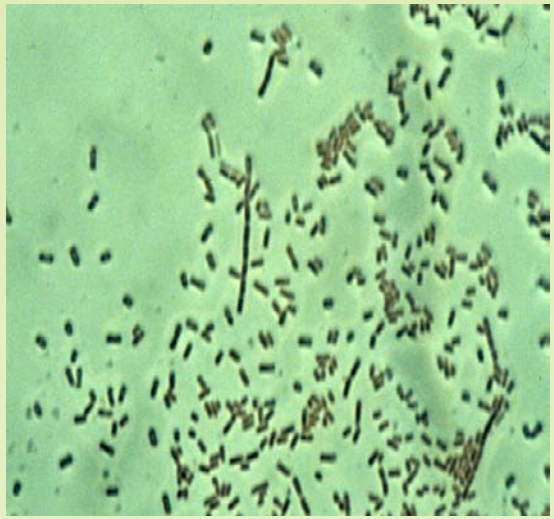
Soil-Dwelling "Vampires"

(Amoebae that eat Fungi)



Bacteria

(decompose Organic matter)



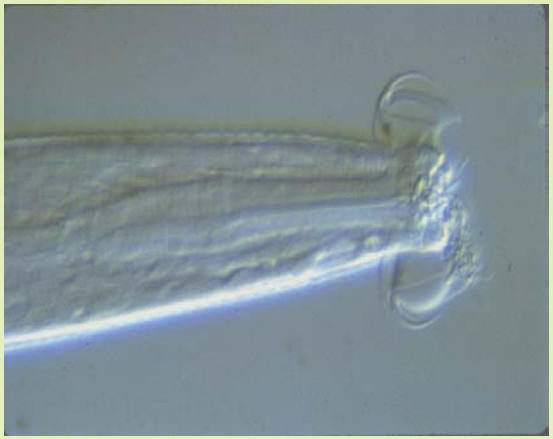
Predatory Nematode

NEMATODES

Predatory Nematodes eat bacterial-feeding nematodes, root-feeding nematodes, fungal-feeding nematodes and other soil microorganisms (e.g., protozoa)

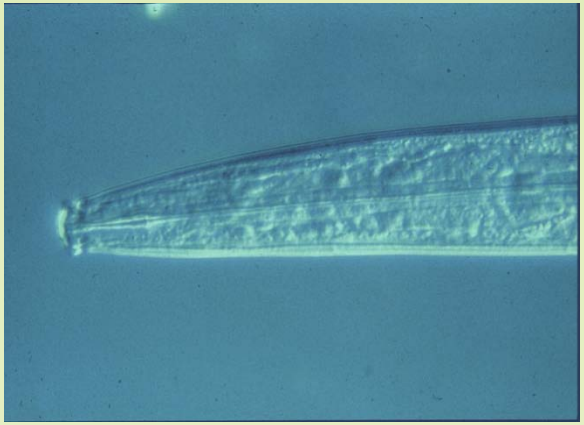
Nematode-Trapping Fungi (the nematode becomes lunch for the fungus)

Bacterial-Feeding Nematode



Root-Feeding Nematode

Fungal-Feeding Nematode



Earthworms (Soil Engineers)

Earthworm channels

(Sandy soil near Abiqui, NM)

Earthworms bury litter

Earthworm burrow

Earthworm casts

Herbivores

Symphylan
(feeds on plant roots and
can become a major crop pest
if its population is not controlled
by other organisms)

Mole-Cricket
(they chew roots and are
common in pastures and cropland)

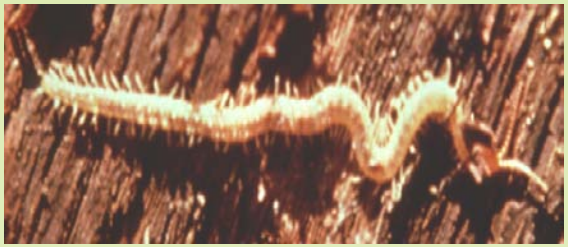
Predators:

Pseudoscorpion

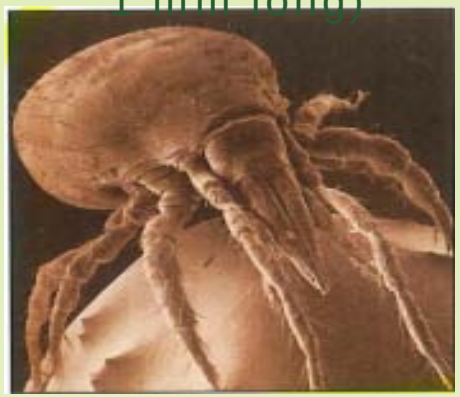
Tiger Beetle

Predatory Mite (A predacious mite feeds on a springtail)

Centipedes



Predatory mites prey on nematodes, springtails, other mites, & the larvae of insects (this mite is 1 mm long)



Wolf Spider

Biodiversity is critical to sustainable cropping systems