



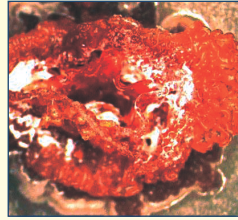
Underground and unseen by the naked eye, best describes most soil organisms

Soils are the world's largest reservoirs of biological diversity which is crucial to the functioning of terrestrial ecosystems. A gram of soil contains more than a billion bacteria and less than 5% of them have been cultured. Soils are spatially and temporally heterogeneous and soil microbial populations are critically affected by plant roots and crop residue quality.

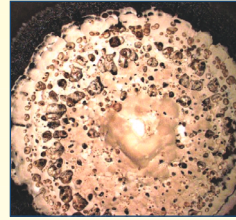
Microorganisms impact on human health and crop yields. Their activities helped create the biosphere and continue to support life processes on earth. They play an important role in a diverse array of beneficial and deleterious functions. More than 80% of all biological activity in soil can be attributed to microorganisms.



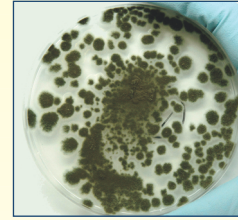
Rhizosphere soil - a diverse and complex environment



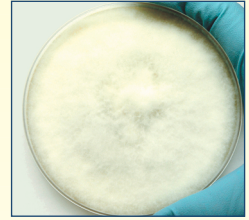
Actinomycete



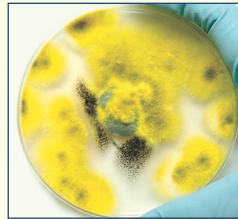
Actinomycete



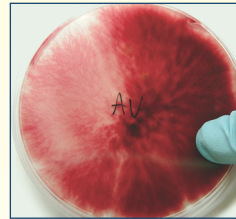
Soil Fungus



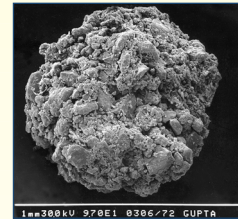
Soil Fungus



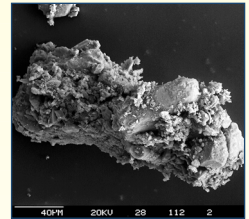
Soil Fungus



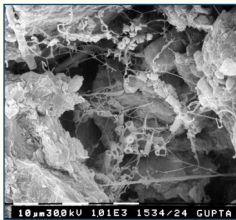
Soil Fungus



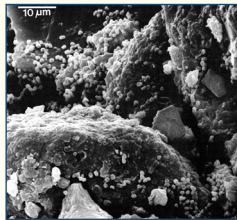
Water-stable aggregate



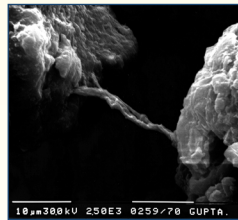
Micro-aggregate



Microbes in a soil pore



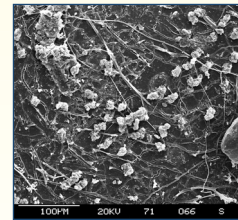
Microbes on an aggregate



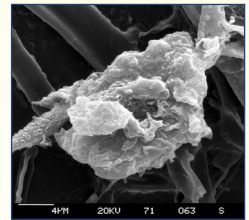
Hyphal bridge



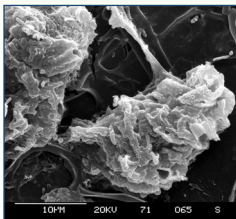
Free-living nematode



Amoebae feeding on Rhizoctonia



Fungal-feeding amoeba



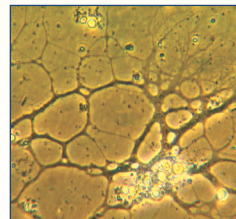
Bacterial-feeding amoeba



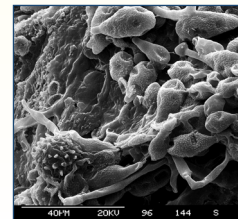
Amoeba feeding on fungus



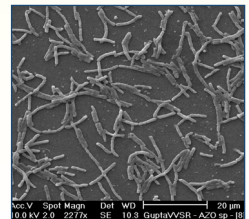
Ciliate



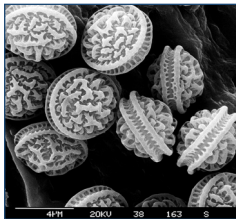
Amoeba



Pythium species



N₂ fixing bacteria







Fungal spores



Collembola

Soil organisms are classified into various groups based on their size and food preferences

Group	Organisms	Size range	Functions	Microscopes required
Microflora	Bacteria Actinomycetes Fungi Viruses	0.02-5µm 1-2µm (hyphae less than 1 µm thick) Hyphae 1-4µm thick and can cover km distance 50-100nm	<ul style="list-style-type: none"> Organic matter turnover Nutrient mineralization Aggregate formation Disease incidence Disease suppression Degradation of pollutants Greenhouse gas production 	Research microscopes Electron microscopes 
Microfauna	Protozoa Nematodes	5-200µm 10µm-2mm	<ul style="list-style-type: none"> Regulate bacterial and fungal populations (predation) Nutrient cycling Disease suppression Disease incidence 	Stereo microscopes Research microscopes 
Mesofauna	Collembola Mites	250µm-2mm 100µm-2mm	<ul style="list-style-type: none"> Nutrient cycling Regulation of bacterial and fungal populations Fragment plant residues Create biopores Aggregate formation (faecal pellets) 	Stereo microscopes Powerful magnifying lens 
Macrofauna	Earthworms Beetles Ants Termites	Visible to naked eye	<ul style="list-style-type: none"> Fragment plant residues and organic matter distribution in the profile Stimulate microbial activity Can affect fungal pathogen inoculum Create biopores and modify drainage Aggregate formation and soil structure 	Stereo microscopes Powerful magnifying lens 

ACKNOWLEDGMENTS A number of current and former colleagues at CSIRO, Margaret Roper, Alan Bird, Petra van Vliet, Stuart McClure and Richard Lardner.

ADDITIONAL READING

<http://www.biology.ed.ac.uk/research/groups/jdeacon/microbes/index.htm>
<http://www.microorganisms.com/>
http://www.soilhealth.segs.uwa.edu.au/soil_biology
<http://www.csiro.au/resources/pfrc.html>

