Nematode-based Tools for Assessing Soil Health

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“If all the matter in the universe except the nematodes were swept away, our world would still be dimly recognizable,... We should find its mountains, hills, vales, rivers, lakes, and oceans represented by a thin film of nematodes.” (Cobb, 1914)

Ecological Relevance of Nematodes

- Ubiquitous
- Most abundant invertebrates in soils (up to 40 millions ind/m²)
- High taxonomic and functional diversity: 27,000 described species (40% are free-living); various feeding types (Fig. 1)
- Key-drivers in soil food webs (e.g. by stimulating bacterial and fungal growth; Fig. 2)
- Offer several tools for bioindication (Fig. 3-6)

Functional diversity

![Functional diversity](Image)

To assess soil biodiversity, nematodes should be included as they are speciose, trophically diverse and easily extractable.

Natural nematode assemblages constitute an ecologically meaningful and innovative high-throughput tools in ecotoxicology

Hence, nematodes are versatile bioindicators for soil health

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Fig. 1: Nematodes (Fotos W. Traunspurger; from Schmidt-Rhaesa 2013: Handbook of Zoology; De Gruyter-Verlag)

Fig. 2: Schematic diagram generalizing the complex trophic interactions between free-living nematodes and microorganisms, other meiofauna and macroinvertebrates in terrestrial subsurface food webs; redrawn from Schratzberger et al. 2019; BioScience, 69, 867-876.

Fig. 3: Tiered Risk Assessment

Fig. 4: NOEC (reproduction) ranges for pesticide groups tested with various standard test organisms (Nematodes: Caenorhabditis elegans; Earthworms: Eisenia fetida; Collembolans: Folsomia candida; Milieu: Hypoaspis milieus)

Fig. 5: Effects of Zn on total nematode density in microcosms spiked with Zn; Data of current DBU-Project (Grant: DBU 33600/01-31)

Fig. 6: Correlations between the relative abundance of seven nematode taxa identified by DNA-Metabarcoding and microscopic community analysis (Geisen et al. 2018)