Effects of nitrogen fertilization on soil fauna – A global meta-analysis

Bibiana Betancur Corredor\textsuperscript{1,2}, Birgit Lang\textsuperscript{1,2}, and David Russell\textsuperscript{1,2}

\textsuperscript{1}Senckenberg Museum of Natural History Görlitz, Germany
\textsuperscript{2}Bonares – Center for Soil Research, Germany

The impact of agricultural activities on soil fauna can be highly variable, depending on the management options adopted. High-input agricultural practices can promote a reduction in diversity of soil microarthropod communities but, at the same time can also favor bacterial-feeding fauna through the increase of bacterial food web pathways. In contrast, low-input practices can increase the dominance of fungal-feeding fauna through the promotion of fungal pathways. Responses also vary with time after fertilizer application and are strongly dependent on crop species or shifts in plant species composition due to fertilization. The type of fertilizer, organic or inorganic, can also have diverse effects on soil organisms. Organic fertilizers can increase the population of soil decomposers serving as nutrient sources for other soil organisms. Nitrogen fertilization may disturb soil organisms in a manner that affects ecosystem functioning, but the links are not yet well quantified. Therefore, a systematic compilation of available experimental data on the effects of nitrogen fertilization on taxonomic and functional groups of soil fauna is needed to clarify the patterns and mechanisms of responses.

Paired observations for meta-analysis were collected from 198 studies published in the last 30 years across 37 countries. First results show that nitrogen fertilization increased the biomass of earthworms (mean increase of 19.7\%), the abundance of nematodes (mean increase of 36.6\%), springtails (mean increase of 29.7\%), and mites (mean increase of 35.2\%), and reduced the abundance of earthworms (mean reduction of 9.2\%) compared to when no fertilizer was applied. The population responses of all organisms were larger when organic fertilizers were applied. The meta-analyses for different earthworm ecological groups showed that the biomass of epigeic and endogeic earthworms were most sensitive to organic fertilization, and this effect was magnified when higher rates of nitrogen are applied. The meta-analyses for different nematode feeding groups, life-form groups of springtails and mite suborders showed that each group is affected differently by organic and inorganic fertilization. Additional meta-analysis also showed that the responses of the soil organisms to nitrogen fertilization can also be modulated by physicochemical properties of the soil as well as climatic conditions.