Nematode Community Development in Organic Matter Amended Soil

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ABSTRACT. Free living soil nematodes significantly contribute to decomposition of organic matter. Their community establishes decomposer food web due to their varied position in the trophic levels, thus they indicate soil food web condition. The food web consists of fungal, and the bacterial channels. This research was based on the idea that maintaining both decomposition channels could maintain soil quality, and increasing fungal channel might provide more sustainable environment. The research objective was to observe the relationship between organic matter quality and nematode community development. This was done by amended forest soil with organic matter of various C and N ratio as the indicator of its quality. Seven treatments were set up for this green house experiments, including no amendment (P0), organic matter amendment with C:N of 6.54 (stimulant: P1), 7.08 (organic fertilizer: P2), 9.01 (plant litter: P3), 17.81 (manure: P4), 1309.44 (sawdust: P5), combination of P1-P5-P2 (P6), and combination of P1-P5-P3 (P7) with four replicates. Nematode community was measured every two weeks for ten weeks, and were classified into their functional groups. The results showed organic matter amendment increased overall nematode abundance and their functional groups (wilk's lambda < 0.001) with greater increase in P6 and P7. Nematode community developed toward bacterial feeder domination in P0, P2, and P4, whereas fungivorous nematodes were observed in P1, P3, P5, P6, and P7. Channel index indicating fungal decomposition channel was observed in P1, P5, P6, and P7 (0.09 – 0.37). CCA revealed strong correlation between organic matter amendment and nematode community (axis-1: 0.85).

***Keywords*:** bacterial and fungal feeders, C and N ratio, decomposition, organic matter, nematode community.

Introduction

Free living soil nematodes play a crucial role in the decomposition of organic matter in soil (Mikola and Sulkava 2001). They are an essential component of the soil food web and indicate the overall condition of the soil ecosystem (Neher, Weicht, and Barbercheck 2012). The soil food web consists of various trophic levels, including fungal and bacterial channels, which contribute to the decomposition process. It is hypothesized that maintaining both decomposition channels can improve soil quality, and increasing the fungal channel may lead to a more sustainable

environment. This research aims to investigate the relationship between organic matter quality and the development of nematode community.

Methods

The research was conducted in a greenhouse using forest soil amended with organic matter of varying carbon to nitrogen (C:N) ratios to indicate its quality. Seven treatments were established: no amendment (P0), organic matter amendment with C:N ratio of 6.54 (stimulant: P1), 7.08 (organic fertilizer: P2), 9.01 (plant litter: P3), 17.81 (manure: P4), 1309.44 (sawdust: P5), a combination of P1-P5-P2 (P6), and combination of P1-P5-P3 (P7) with four replicates. Nematode community was measured every two weeks for ten weeks, and were classified into their functional groups according to (Ferris, Bongers, and De Goede 2001).

The data were analyzed with canonical correspondence analysis (Šmilauer and Lepš 2014) to investigate the relationships between the nematode community and organic matter quality indicating by their C:N ratio.

Results

The results of the study indicated that organic matter amendment had a significant impact on overall nematode abundance (wilk's lambda < 0.001). Specifically, the abundance of nematodes belonging to functional groups P6 and P7 showed a greater increase compared to other groups. This finding suggests that organic matter amendment positively influences the population size of nematodes in these particular functional groups.

The study also revealed interesting trends in the development of nematode communities across different treatments. In treatments P0, P2, and P4, the nematode community shifted towards bacterial feeder domination. This suggests that the organic matter amendment favored the growth of bacteria, which in turn attracted bacterial-feeding nematodes.

On the other hand, treatments P1, P3, P5, P6, and P7 exhibited the presence of fungivorous nematodes. This implies that the organic matter amendment promoted the growth of fungi, creating a favorable environment for fungivorous nematodes to thrive. These findings highlight the importance of considering specific functional groups when studying nematode communities, as different amendments can have varying effects on their composition.

The presence of a fungal decomposition channel, as indicated by the channel index, was observed in treatments P1, P5, P6, and P7, with values ranging from 0.09 to 0.37. This finding suggests that the organic matter amendment contributed to the decomposition of fungal biomass, potentially enhancing nutrient cycling in the soil. Understanding the dynamics of decomposition channels is crucial for nutrient availability and overall soil health.

Canonical Correspondence Analysis (CCA) revealed a strong correlation between organic matter amendment and nematode (axis-1: 0.85).

Conclusion

Enhancements of organic matter with low C:N ratio stimulated the bacteria and their feeders, whereas those of high C:N ratio supported the development of fungi and the fungal feeders.

References

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