The functional role and diversity of soil nematodes are stronger at high elevation in the lesser Himalayan mountain ranges

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Abstract

Soil nematodes are a foremost component of terrestrial biodiversity, they display the whole gamut of trophic guilds and life strategies, and by their activity, affect major ecosystem processes, such as organic matter degradation and carbon cycling. Based on nematodes' functional types, nematode community indices have been developed and can be used to link variation in nematode community composition and ecosystem processes. Yet, the use of these indices has been mainly restricted to anthropogenic stresses. In this study, we propose to expand the use of nematodes' derived ecological indices to link soil and climate properties with soil food webs, and ecosystem processes that all vary along steep elevation gradients. For this purpose, we explored how elevation affects the trophic and functional diversity of nematode communities sampled every 300 m, from about 1000 m to 3700 m above sea level, across four transects in the lesser Himalayan range of Jammu and Kashmir. We found that (1) the trophic and functional diversity of nematodes increases with elevation; (2) differences in nematodes communities generate habitat-specific functional diversity; (3) the sigma maturity index, the channel index, and the metabolic footprint of nematodes increase with elevation, indicating less mature and less productive ecosystems, enhanced fungal-based energy flow, and a predominant role of nematodes in generating carbon influxes at high elevation sites, respectively. We thus conclude that the functional contribution of soil nematodes to belowground ecosystem processes, including carbon and energy flow, is stronger at high elevation. Overall, this study highlights the central importance of nematodes in sustaining soil ecosystems and brings insights into their functional role, particularly in alpine and arctic soils.

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