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Nematode Response to Soil Rehabilitation of A Nickel Mining Area: A Case Study of Hinatuan Island, Tagana-An, Southern Philippines

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Extended Abstract

Ore mining activities, small and large-scale, have been an important contributor to the Philippine economy. However, mining is often linked to soil degradation, decline in soil fauna diversity and deterioration of human health. Soil restoration aims to bring back the 'pre-disturbed' soil conditions of an impacted area. It typically includes backfilling of soil materials, addition of organic amendments and beneficial fungi, and re-vegetation. In this study, we examined the response of soil nematodes of a rehabilitated mining area in Hinatuan Island, Surigao, southern Philippines by comparing the nematode communities and the physico-chemical properties of the soils of the two rehabilitated sites from a nearby unmined site and a mined-out site. Nematodes are crucial players in several soil processes [1], e.g., decomposition and nutrient cycling. Nematodes were collected in April 2019 and identified to the genus level using morphology-based identification techniques [2]. Basic soil characteristics (e.g., pH, OM, soil texture, N and P) and heavy metal concentrations (e.g., Ni, Cu, Zn, Pb and Cd) were determined. Results showed that the basic soil properties of the two rehabilitated sites (2012 rehabilitation and 2015 rehabilitation) resembled to that of the Reference site, while they differed to that of the Mined-out site. Moreover, the heavy metals Pb and Cd were significantly higher in the Reference site compared to the Mined-out site. While Cu level remained fairly similar in all study sites, other metals, such as Pb and Cd, remained comparable in both rehabilitated sites. Zn, on the other hand, was only significantly higher in the 2012 rehabilitation than in the Reference site, while statistically comparable to the rest. Except for Cd and Ni, all metal contents in the area were well within the permissible levels based on international guidelines. Nematode abundances were higher in 'older' rehabilitated site than the 'recent' one (abundance in 2012 rehabilitation > 2015 rehabilitation), albeit both were lower than the unmined site. Nematodes were, however, non-existent in the mined-out site probably due to the removal of topsoil layer. Shannon index values were also higher in the rehabilitated sites than the unmined site. In terms of genus composition, the two rehabilitated sites shared did not differ in each other but both sites showed significant differences to the reference and mined-out areas. Several 'sensitive' genera such as predators and omnivores, were present in both rehabilitated sites, which can be indicative of improving soil conditions in rehabilitated mined sites. Since nematodes can exhibit substantial variations over short and long-term spatial scales, especially in limited number of samples, caution is needed in the interpretation of results of the study. Hence, a regular monitoring is highly recommended to further examine the response of nematodes and identify effective strategies in the rehabilitation of impacted areas in southern Philippines using nematodes as indicators of soil health improvement.

Keywords: biomonitoring, nematodes, nickel mining, soil rehabilitation

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