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Critical significance of oligochaetes in enhancing the fertility of the soil

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Abstract

The study examines the impact of three epigenic earthworms, Periyonix excavatus, Eudrilus eugenia, and Eisenia foetida, on vermocomposting as well as the impact of the endogenic earthworm Pontoscolex corathrurus on soil fertility and plant growth. Year-round abundance of P. corathrurus varied from 4.95 to 19.6 for adults, 2 to 13.25 for juveniles, and 2.2 to 7.3 for cocoons at the organic farm site, and from 2.21 to 15.6 for adults, 1.5 to 11 for juveniles, and 0.8 to 4.6 for cocoons at the integrated farm site. Worm casts are much higher in N (9.7-6.5%) and C (5.7-3.5%) content than surrounding soil, which is a result of P. corathurus activity, than the surrounding soil. In all locations, the pH of the casts was neutral compared to the varying pH of the nearby soils. P. corathurus considerably accelerated Zea maiz growth when it was injected with seven earthworms per pot in pot experiments. The three epigenic earthworms that were chosen were cultured in seven composting media that contained varying amounts of rice straw, vegetable waste, and cow dung. The results revealed that the inclusion of cow dung greatly boosted the multiplication rate. In comparison to the controls, vermicomposting produced compost with higher amounts of N, P, Fe, and Mn as well as better particle size. The study's findings show that Sri Lankan earthworms can be easily employed to increase soil fertility and create vermicompost without the need to bring in exotic species.

Key words: Pontoscolex corathrurus, Periyonix excavatus,

Introduction

In terms of evolution, earthworms (EWs) are a very ancestor species. They were able to adapt to various environmental circumstances and endure for over a million years. Their habitat consists of moist, organically rich soil. They are penetrating the skin and are extremely sensitive to changes in temperature, light, and touch. They burrow deeper layers during the winter to protect from low temperatures, and during the summer and dry conditions; they do the same to prevent dehydration. The circular (segments) and longitudinal muscles that make up their muscle system allow the EWs to move by contracting and expanding them. Small fluffs that cover the EWs' bodies are crucial for environmental adaptation and the quest for food in the soil. EW diet waste products replenish the soil with nutritious elements that promote plant growth. However, a large number of animals in the soil eat a lot of the EWs. They are hermaphrodites,

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which mean that each possesses both female and male reproductive systems. Because the animals can reproduce so easily, this trait also helps the creatures adapt to their surroundings. The eggs are protected in the soil by a capsule that develops from the clitellum's secrets (front part). The newborn worm is shielded by the capsule until full development. The majority of organic stuff that is dead or deteriorating is broken down by the EWs, who get their sustenance from the bacteria and fungi that develop on these materials. They contribute significantly to recycling the nutrients by decomposing organic debris. The EWs are found in many tropical soils including the warmest soils. More than 700 genera, 23 families, and more than 7,000 species make up this group. They can be found seasonally at all soil depths and range in size from an inch to two yards.

Earthworms in soil fertility

Since Darwin's publication of "The creation of vegetable mould via the action of worms with observations on their habits" in 1881, the importance of EWs in soil fertility has been understood. Following that, other investigations were published. Through disruption and the creation of biogenic structures, soil macroinvertebrates play a significant role in the transformations of soil organic matter (SOM) and nutrient dynamics, improving soil fertility and land productivity. SOM is a significant source of active carbon and a crucial element of soil fertility. Numerous soil characteristics, including soil structure, porosity, water retention, cationic exchange, and pH buffering capability are influenced by it. For that reason, it has been postulated that soil aggregates serve as the structural components of the soil that regulate the dynamics of SOM and nutrient cycling. The EWs are a significant part of soil fauna communities. They are frequently linked to fertility and productivity in cultivated tropical soils that contain organic materials. By controlling the processes of mineralization and humification in such an ecosystem, the invertebrate groups, notably EWs, may play a crucial part in the dynamics of the SOM. Ecological categories affect how EWs affect soil biological processes and fertility levels differently. Endogeic species live in the soil's upper mineral layer, epigeic species dwell on the surface of the soil, and anecic species are active in the soil's deep mineral layers. Most of the time, combinations of these ecological groups are in charge of preserving the soil's fertility. By influencing the soil's physical characteristics, nutrient cycling, and plant growth, EWs play a significant role in delivering the nutrients (N, P, K, and Ca) through the production of aggregates and pores (i.e., biostructures) in the soil and/or on its surface. Depending on the time and space scales addressed, different EWs have different effects on the dynamics of organic matter . Endogeic EWs increase initial SOM turnover in the humid tropical climate by indirectly influencing soil C as microbial activity enters the

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environment. Additionally, it has been observed that EWs promote the incorporation of C from cover crops into macro aggregates and the micro aggregates that develop within of macro aggregates. As a result, the increased transfer of organic C and N into soil aggregates suggests that EWs may help SOM accumulate and stabilize in agricultural systems. Additionally, EWs boost nitrogen mineralization through influencing the microbial community both directly and indirectly. Studies have showed that the addition of slashed vegetation, inorganic and organic manure, recycled agricultural residues, and weeds increased the quantity of soil nitrogen that was available for plants more than the total input. The significant rise in soil pH is one of EWs' key functions. The type of cropping system and the type of fertilizer used (mineral versus organic) seem to be the determinants of how much of an impact EWs have on N cycling. Additionally, the EWs can improve the availability of nutrients in systems with less human interference, including less tillage, less use of mineral fertilizer, and low organic matter content. Although the importance of EWs in increasing soil fertility has long been known, research findings have helped to clarify this understanding. Bhaduaria and Saxena (2010) have studied more information on this topic. The Lumbricidae family, which comprises the genera Lumbricus and Aporrectodea, is the most crucial group of EWs for improving agricultural soil. Lumbricides are a product of human activity and have spread over the world from Europe.

Conclusion

At the two differentially managed farm sites, the seasonal abundance of Pontoscolex corathrurus casts, adults, and developmental stages was correlated with rainfall patterns. Casts had higher total C, N, and pH values than the nearby soil. This suggests that P. corathrurus has an ongoing effect on the soil despite the fact that pot experiments showed a noticeable improvement in plant growth. This is made easier by the fact that, according to the author's study, P. corathrurus is the dominating species of earthworm in disturbed soils. In Sri Lanka, vermiculture and vermicomposting with the three earthworm species Eudrilus eugenia, Eisenia foeitida, and Peryonix excavatus can be done successfully. Vermicompost had better particle size improvement and more readily available plant nutrients. As a result, this method of composting is effective and improves the nutrients for plants. All kinds of organic waste that gather in farms, marketplaces, and homes could be recycled using this method of composting. Further investigation is needed into the overall role that earthworms play in soil improvement and vermicomposting in Sri Lanka. The earthworms that are frequently found in disturbed areas are a resource that might be leveraged to increase soil fertility and create large-scale vermicomposting programs to ensure agricultural sustainability.

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