

10.

STUDIES ON SOIL MACRO FAUNA IN JAFFNA, SRI LANKA – PRESENT STATUS AND FUTURE PLANS

R. Gnaneswaran

Department of Zoology, Faculty of Science, University of Jaffna.

rajignanes@yahoo.com

ABSTRACT

Soil inhabiting invertebrates are the mentors of the healthy soil in all ecosystems. They improve the structure and the quality of the soil by increasing aeration, water holding capacity litter decomposition which enhance microbial activities and promotion of crop production. Biological properties are one of the indicators to assess soil quality. A healthy soil contain abundant and diverse invertebrates and their population will increase with the required food and habitat. Studies on soil macro invertebrates in Jaffna Peninsula are scanty and limited works have reported on vermiculture and not on the status of other fauna as indicators. Therefore, a baseline study was proposed to record existing soil macrofauna in different ecosystems in order to develop a programme to assess and improve the soil health after various management practices based on the variety and number selected soil macrofauna as bioindicators.

The observations of the pilot study are reported in this paper with the methodology for the proposed work. The species richness and abundance of soil macro fauna in cultivation areas differ from the undisturbed area of dense vegetation.

INTRODUCTION

Soil is a renewable resource, composed of living – micro, meso and macro organisms and non living matters – minerals, organic matters, gases and water and therefore, is considered as an ecosystem. Since soil is the basis for crop production and livestock management, overuse of land for managed agriculture degrades forests, turns fertile lands into deserts and pollutes soil and water, ultimately diminishing biodiversity. One of the main drawbacks in most agricultural management systems is not considering the practices that promote and manage soil biodiversity in a way to maintain and improve soil fertility.

Among the organisms in soil, the macro fauna which are in size more than 1 cm, includes earthworms, millipedes, insects, snails and spiders, are vital in ecological processes such as nutrient dynamics, carbon accumulation, activating soil microorganisms and also to improve soil health and reduce the incidence of pests and soil borne diseases. (Menta, 2012)

In Jaffna, agriculture mainly depends on agrochemicals to achieve the target yield, due to the limitation of land availability as a result of the long-term war. The production has been increased while causing stress to the environment leading to loss of crop cultivars, soil health, natural control of pests and pollination. Studies on the relationships between soil fauna and the agriculture in Jaffna Peninsula, are scanty and limited works were reported on vermiculture (Milunthan and Piratheepan, 2006, 2007) and not on the status of other fauna.

Lack of awareness among farmers about the issues relating to soil organisms and their functions leads to further damage to the ecosystem by adding more and more agrochemicals.

Therefore, this study was focussed to make available information on soil fauna in different agro ecosystems in Jaffna to obtain a spectrum of soil macro fauna to assess the potential species diversity in natural ecosystems as a standard against which to compare the agro ecosystems. This information will be used to establish base line data for this region.

METHODOLOGY

The study was proposed to be conducted in two main stages, first, as a rapid survey and then as a systematic survey, to sample soil macrofauna.

Three different sampling methods were proposed - Monolith sampling method, Pitfall method and Transect sampling methods (Fatima *et al*, 2008). During February 2013, four sampling sites in Jaffna, based on the different land use pattern (A) a Paddy field (B) cabbage field, (C) an undisturbed grass land and (D) a mango orchard, were selected for rapid soil macrofaunal survey. Soil samples from each site were collected during midday at a depth of 0-15 cm using a soil corer of 5cm diameter and macrofauna were then sorted out into morphospecies. This was repeated two times at the same site with 1 meter distance from the first sample location.

Systematic sampling is planned to be conducted weekly in five randomly selected sampling stations, in survey sites representing five ecosystems, namely, site I- where paddy cultivation is during *Maha* season only, site II- where paddy cultivation is done during *Maha* season and vegetable cultivation is done during *Yala* season, site III- Vegetable cultivation in *Yala* season, Site IV; -Banana plantation and Site V- Perennial fruit crop cultivation e.g. Mango.

RESULTS AND DISCUSSION

The results obtained by the rapid field survey revealed greater diversity of soil macro fauna in undisturbed sites than in the sites manipulated for various agricultural activities. A total of 99 individuals in 39 morphospecies were found distributed among 05 taxonomic groups. The information given in Table 1 *i.e.* Insects, earthworm, snail, crustacean, millipede- are not taxonomic classes. They are common names. The highest species richness was observed in Site D – undisturbed mango orchard with 14 morphospecies where as the lowest richness was found in Site B with 06 species.

Table 1: Composition and abundance of soil macro fauna collected in February 2013 in Jaffna.

Land use	Site A Paddy field	Site B Cabbage field	Site C Grass land	Site D Orchard
Macro fauna collected				
Insects (of six orders)	13 (7)	12 (4)	18 (6)	27 (9)
Earthworm	0	2 (1)	1(1)	8(2)
Snail	4 (1)	2(1)	2(1)	1(1)
Crustacean	5 (1)	0	0	1(1)
Millipede	0	0	0	2(1)
Total morphospecies	(9)	(8)	(8)	(14)

** The number of morphospecies in given in parenthesis

DISCUSSION

Cropping generally leads to a decrease in soil macrofauna. The use of perennial crop covers and mulch helps to restore soil biodiversity (Boyer *et al*, 2001). It has also been reported that the soil macrofauna composition increased in agroecosystem than in natural forests (Ayuke, 2009). In the present rapid survey, though site C is undisturbed like Site D, the surface was covered with litter as well, supporting more morphospecies (14) than other ecosystems. Sites A and B are frequently disturbed through cultivation practices and housed similar number of morphospecies but their functions may be different. This rapid survey expressed an outline of the current status of the soil macro fauna in Jaffna, in relation to agroecological practices. The detailed study of this faunal group would help farmers and extension officers to assess soil health status and to develop adapted management practices to sustain and improve soil quality under a range of different farming systems.

REFERENCE

- Anderson JM and Ingram JSI, 1993. Tropical Soil Biology and Fertility: a Handbook of Methods. 2nd Ed, CAB International, Wallingford. Dufrene, M, and P. Legendre 1997. Species assemblages and indicator species: The need for a flexible asymmetrical approach. Ecological monograph 67:(3)345-366.
- Ayuke, FO, Karanja, NK, Musombi, BK and Nyamasyo GHN (2009) Macrofauna diversity and abundance across different land use systems in embu and taita, Kenya URI: <http://erepository.uonbi.ac.ke:8080/xmlui/handle/123456789/11253>
- Boyer ,J, A. Chabanne, and L. Seguy 2001. Impact of cultivation practices (Cover crops) on soil macrofauna in Reunion (<http://agroecologie.cirad.fr/content/download/6893/33032/.../1001714429.pdf%E2%80%8E>)
- Fatima M.S. Marina, E.J. Huising and David E. Bignell 2008 A hand book of tropical soil biology- Sampling and Characterization of below ground biodiversity pp 218
- Mikunthan G. and Piratheepan. A 2006. Suppressive effect of neem leaves on barnyard earthworm , *Eisenia foetida* presented at a workshop on “ Neem research in Sri Lanka: current Trends and Future Prospects” on 3-4th August at NSF Sri Lanka.
- Mikunthan G. and Piratheepan. A 2007. Performance of epigeic earthworm species in different solid wastes for compost making. Proceedings of ICSW 2007- The 22nd International Conference on Solid Waste Technology and Management, March 18-21, Philadelphia, PA, USA
- Norman F. J. and Triplehorn. C. A 2004. Borror and DeLong's Introduction to the Study of Insects.
- Ruiz, N., Lavelle, P. and Juan, J. 2008. Soil Macro fauna field manual- Technical Level by FAO pp100
- Menta, C. 2012. Soil Fauna Diversity, Function, Soil Degradation, Biological Indices, Soil Restoration. Chapter 3 In. Biodiversity Conservation and Utilization in a diverse world Pp 59-93.