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Earthworm Resources and Soil Parameters of Chittur, Palakkad and Kanuvai, Coimbatore, India

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A B S T R A C T

Earthworm diversity and distribution patterns are generally governed by a variety of biotic and abiotic factors such as soil properties, surface litter, vegetation type and, land use pattern, local or regional climate and anthropogenic activities. In the present study we have analysed the earthworm diversity and soil analysis of Chittur, Palakkad, Kerala and Kanuvai, Coimbatore, Tamil Nadu. The results revealed that four different species of earthworms belonging to three families found in two sampling stations and also analysed the influences of the soil parameters includes macro and micro nutrients on the earthworm diversity.

Introduction

Soil needs energy for the growth of the biological organisms. Most of this energy comes indirectly from sun via the primary producers. This deliver energy rich organic compound into soil either in the form of litter or by direct absorption through roots. Besides microbes earthworms are highly involved in energy and carbon cycling in soils. Earthworms belong to the phylum Annelida; class Oligochaeta, evolved in past Precambrian period. They have the applications in both agro-ecosystem and therapeutic areas and also used for the solid waste management. India is one of the major earthworm diversity countries and has 11.1% available out of total earthworm diversity in the world. Totally 505 species and sub-species of earthworm belonging to 67 genera and 10 families have been identified from India (Kathireshwari, 2016). Oligochaetes are often divided into two convenient groups Microdrili and Megadrili. During the last Decade (Ismail, 1997) much Taxnomic work on Indian earthworms has been carried out by Julka, 1975, 1988 and Easton, 1982. Earthworms are among the most important components of soil biota in terms of soil formation, maintenance of soil structure and fertility (Bhadauria and Saxena, 2010).

Earthworms have been called "ecosystem engineers", because they change structure of the soil environments. Different types of earthworms can make both horizontal and

vertical burrows, some of which can be very deep in soils. This burrow creates pores through which oxygen and water can enter and carbon dioxide can leave the soil. Earthworm casts are also very important in soils and are responsible for some of the fine crump structure of soils. Earthworms play an important role in breaking down dead organic matter in a process known as decomposition. Decomposition releases nutrients locked up in dead plants and animals and makes them available for use by living plants. Earthworms do this by eating organic matter and breaking it down into smaller pieces allowing bacteria and fungi to feed on it and releases the nutrients. Earthworms are also responsible for mixing soil layers and incorporating organic matter into the soil.

The present study of earthworm diversity and soil analysis was done in the Chittur, Kerala and Kanuvai, Tamil Nadu regions. Chittur village is located in Palakkad district of Kerala. It is a forest area composed of dense plants. The main agriculture plantation of Kanuvai includes paddy and coconut plantations.

Materials and Methods

Study site

Chittur is located at 10.70^0N, 76.75^0E. It has an average elevation of 131m (430ft) and the total area is 1155.10km^2. Chittur is located about 15km from Palakkad town. Sokanashini River flows through Chittur, the average temperature ranges from 25^0c to 28^0c.

Earthworm collection and preservation

The presence of earthworm was located based on availability of worm caste on surface soil and colour and humidity of soil. Adult earthworms were collected by digging and hand sorting method (Julka, 1993) from Chittur, Palakkad. Collection was done during the month of July 2016. Adult earthworms were sorted and taken it to college laboratory along with their native soil. Then washed with distilled water and preserved in 60%formalin solution for identification. The collected specimens were identified by Dr. P. Kathireswari.

Determination of Macro and Micro Nutrients

The determination of macro and micro nutrients of soil inhabited by earthworms were done in soil analysis centre, RS puram, Coimbatore, Tamil Nadu. Macro nutrients like N, P, K and Micro nutrients like Fe, Mn, Zn, Cu, and sulphur were analysed by titration method (Van Reeuwijk, 2002).

Results and Discussion

In the present study we have identified four different types of earthworms from Chittur, Palakkad and Kanuvai, Coimbatore, belonging to three different family Eudrilidae, Lumbricidae, Megascolicidae. The earthworms identified were *Lampito mauritii*, *Eudrilus eugeniae*, *Eisenia fetida* and *Megascolex konkenensis*. The results of soil analysis reveals that nitrogen and potassium are higher in Chittur soil than Kanuvai, and micro nutrients *viz.*, Zn, Cu are also higher in Chittur, due to the presence of earthworm cast and organic compounds, leaf litters. Chitturarea composed of dense trees and high humid condition and has high decomposition by microbes. Kanuvai is mainly an agricultural land and hence have high phosphorous content. The phosphate provides plants with a means of using the energy hardness by photosynthesis to drive its metabolism. Earthworm survey conducted in Chittur and Kanuvai revealed that the occurrence of four species of earthworms namely *Eudrilus eugeniae*, *Esinea foetida*,

Megascolex konkenensis, *Lampitto mauritii*. The earthworm species family and ecological categories are given in table 1.

Lampito mauritii

Taxonamy: It is included in the Phylum: Annelida, class: Oligochaeta, order: Haplotaxida, suborder: Lumbricina and family: Megascolecidae.

Diagnosis: Average length 9-13.5cm, average diameter, 0.29-0.32cm, total number of segment 168-195; prostomium –prolobus.

Distribution: It is a peregrine species, distributed all over the world. Its habitat include garden, manure, heaps, fields etc.

Eudrilus eugeniae

Taxonomy: It includes in the phylum: Annelida, class: Oligochaeta, Order: Opisthopora, Family: Eudrilidae

Distribution: This species of earthworm native to tropical West Africa and now widespread in warm regions, both wild and under vermicompost, and also called the African night crawler.

Eisenia fetida

Taxonomy: It is included in the phylum: Annelid, class-Oligochaeta, order-Haplotaxida, family: Lumbricidae.

Diagnosis: It is smaller in size 3-4 inches long and they have altering bands of darker and lighter colour often with a yellow tip. This coloration comes and goes depending upon the feeding material.

Distribution: They are native to Europe, but have been introduced to every other continent except Antartica.

Megascolex konkenensis

Taxonomy: It is included in the phylum Annelida, class; Oligochaeta, order: Haplotaxida, and family: Megascolecidae.

Distribution: Megascolocidae are largest family of earthworms which has native representatives in Australia, New-Zealand, South-East Asia and North America. These are widely distributed in the tropical and temperate zones

Among the four identified species two earthworms were native and two were exotic. The epigeic and exotic species are *Eudrilus eugeniae* and *Eisenia fetida*. The endogeic species is *Megascolex konkanensis* and the anecic species is *Lampito mauritii*. Among these four species *Eudrilus euginiae* were present in abundant. It may be due to its innate immune mechanism to withstand in various disturbed and undisturbed soil habitat, because it is an exotic peregrine species found in all over the world.

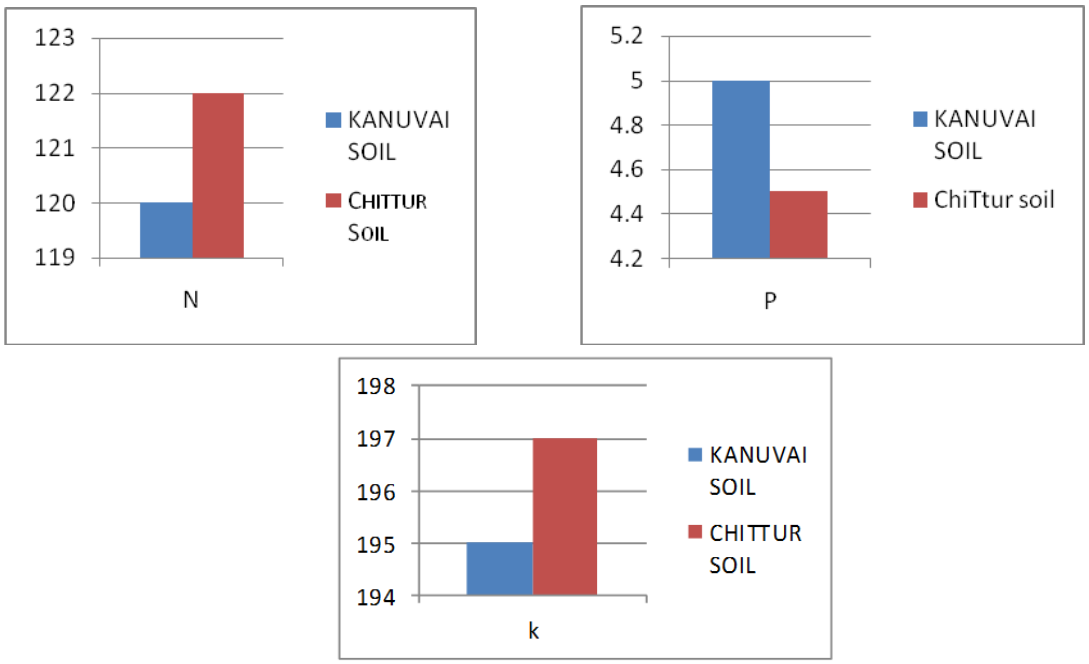
Results of Soil Analysis

The result of soil analysis showed that the earthworms rich in soil have high macro and micro nutrients. In the present study nitrates and potassium level are higher in Chittur than Kanuvai, this is due the presence of more leaf litters. In the present study Kanuvai soil contain high amount of iron and manganese and Chittur contain high level of zinc and copper in soil. Successful colonization of almost all agro-climatic zones in India by the exotic species is mainly due to their inherent ability to withstand disturbances and interference (Julka, 1988) and some widely distributed native peregrine species are able to tolerate disturbed conditions. There are three ecological types of earthworm have been recognized epigeic, endogeic, anecic.

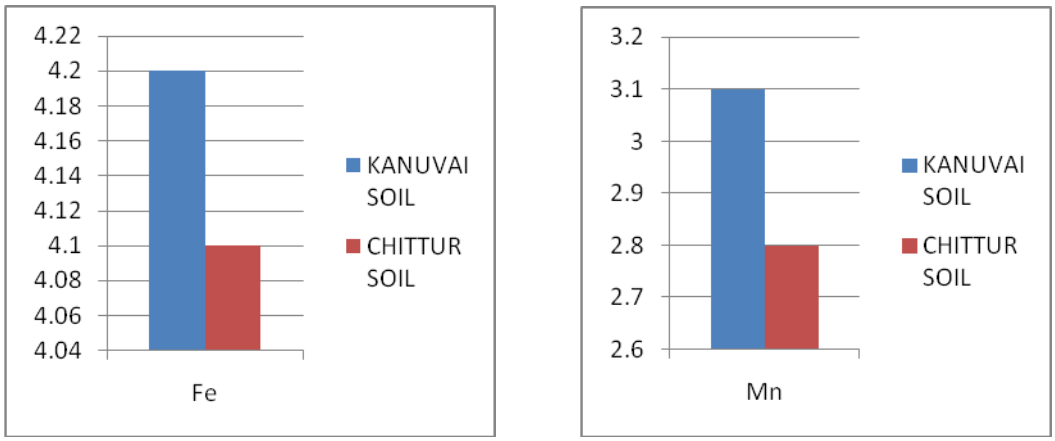
Table.1 Ecological categories of sampled earthworm

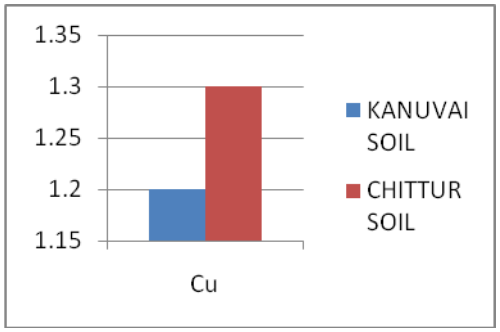
Sl no	FAMILY	SPECIES	ECOLOGICAL CATEGORY	NATIVE/ EXOTIC
1	Megascolecidae	*Lampitomauritii*	Anecic	Native
2	Eudrilidae	*Eudriluseugeniae*	Epigeic	Exotic
3	Lumbricidae	*Eiseniafetida*	Epigeic	Exotic
4	Megascolecidae	*Megascolexkonkenensis*	Endogeic	Native

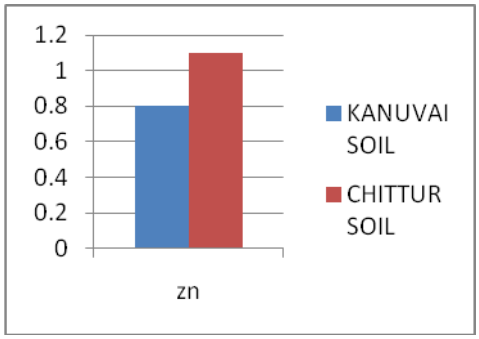
Graph.1 Macro nutrients in the surrounding soil of earthworm in percentage per hectare



Graph.2 the micro nutrient present in the surrounding soil of earthworm in percentage per hectare







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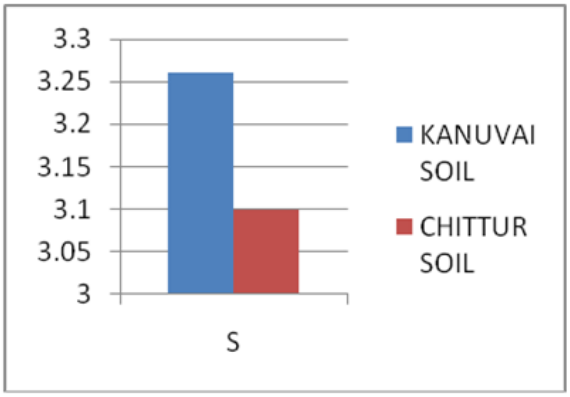
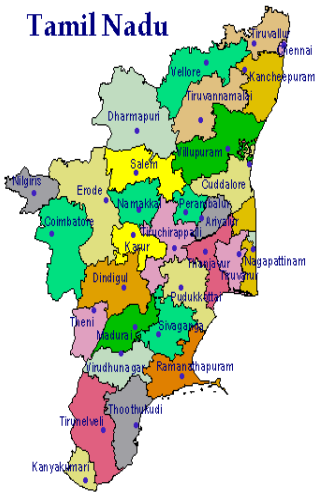
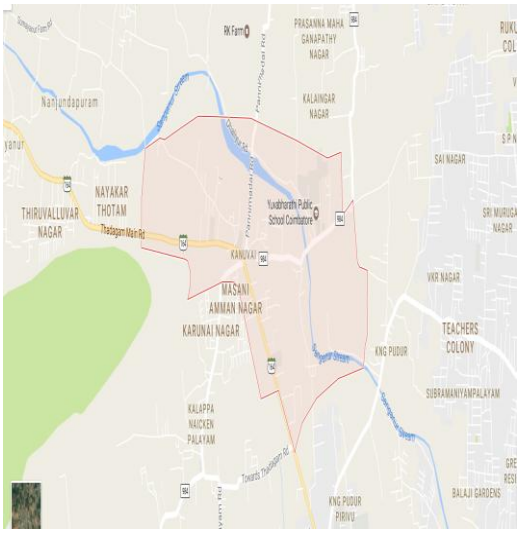


Map showing the study area

Chittur, Palakkad, Kerala





Kanuvai, Coimbatore, Tamil Nadu

Each of this creates earthworm spheres with differing characteristics. The anecic and endogeic are known as soil ecosystem engineers and their impact on soil is great may influence properties and process at the ecosystem level. The functional role of epigeic is primarily that of litter transformers like other litter invertebrates (Lavelle, 1997). Epigeic species living in partially digest surface litter, rarely ingesting soil particles. Their mode of litter processing in natural systems results in grater nutrients leaching in to the soil. Since epigeic species feeds purely on litter and generally have short gut transmit time they probably depend on rapid response on gut microbes to aid in digestion. Earthworm gut preferentially stimulates some microorganisms and reduces others leading to relative dominance of microorganisms different to that found in undigested soils. Anecic are the dominant earthworms (in biomass) in many temperate region soils and (Lavelle, 1983) are primarily vertically burrowing species. They feed on surface litter and more or less are permanent refuges in underlying soil horizon. They often produce characteristics surface features called "middens" which are circular "mound shaped" region around surface of the burrows opening which is mixture of surface organic material and soil. Endogeic cast with generally more clay and frequently more OM than un-ingested soil contain and release significant amount of nutrients and NH_4 (Bariose *et al.*, 1999) than un-ingested soil.

The optimum level of macro and micronutrients are essential for the plant growth. In the present study three macro nutrients (N, P, and K) and five micronutrients (S, Zn, Cu, Mn, Fe) were analysed. The high amount of nitrogen was found in soil sampled from Chittur, Palakkad than the Kanuvai region. This may be due to the presence of more leaf litters and its decomposition in the soil. Whereas the potassium and phosphorus was high in soil sample collected from Kanuvai region. Among the micronutrients analysed the iron, manganese and sulphur were found to be high in Kanuvai soil when compared to Chittur soil and copper and zinc was noticed in high level in soil collected from Chittur. The earthworm worked soil has high level of micro and macro nutrients than the earthworm un worked soil. It is because of large amount of earthworm cast and oraganic compound and presence of leaf litters and their decomposition by microbes and also because of the humid condition.

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