ISSN NO. 2320-5407

Journal homepage: http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Dynamics of earthworm population in relation to decomposition of different plant litter

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Manuscript Info

Manuscript History:

Received: 11 January 2015
Final Accepted: 25 February 2015
Published Online: March 2015

Key words:

Earthworm, Litter, Juveniles, Soil, Temperature,PH.

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Abstract

Dynamics of earthworm population in different soils supporting bamboo, teak, and tamarind grasslands was studied for one year. The earthworm population was more during wet season than the dry season. During wet season earthworm migrated to surface layers, while during dry seasons they migrated to deeper of soil. The population of earthworm in respect of juveniles, pre-adults and adults changed both with the depth of the soil and moisture content.

INTRODUCTION

Earthworms are well known for their role in providing structural stability and soil turnover and also for ameliorating the nutritive status and water infiltration capacity, porosity and other physical conditions to the soil. Thus earthworm population density and biomass management is important for organic forming, soil fertility, soil conservation and waste management. Earthworms migrate vertically in soil strata in response to changes in environment (Keshav Murthy, 1978; Reddy, 1987, Reddy and Pasha, 1993).

Earthworms are widely distributed invertebrates in both tropical and temperate regions of the world. They are found in soils of grasslands, pastures, woodlands and forests which together cover about 80 million square kilometers or about 54% of the land surface of the earth (Whittaker and Likens, 1973). The density, diversity and distribution of earthworms are affected partly by soil structure, soil depth, cultural practices and surface vegetation. They show habitat preference (Lee, 1985). Elduweini and Ghabbour (1965) recorded relationship between population of earthworms with the proportion of gravel and sand in soils. Thus earthworms can survive in variety of soils, provided there is adequate food and moisture.

Based on the tropic relationship of earthworms, they have been categorized into three main ecological types (Lee, 1983) such as (i) Epigenic worms, represented by very small sized worms and found aggregated in the surface layers, (ii) Anecic worms, which are limited and intermediate between litter dewlling and soil dewlling forms, come to the surface for feeding and casting, (iii) Endogeic forms, that live within the mineral horizon of soil, feed on soil organic matter. Majority of earthworms are endogeic, occupying different soil strata. Based on their preference of organic matter at different stages of humification, earthworms are grouped into :

1. Oligohumic – which burrow deep into mineralized soil with poor organic matter.
2. Mesohumic – those lie at depth of 10-30cm, where a higher level of hums is present, and
3. Polyhumic – worms that feed on abundant humus material present in the top 10cm depth of soil.

Population of earthworms may vary with different types of soil. This population variation in different soils was probably due to quantity and quality of available food materials such as plant litter (Cuendet, 1984) and soil type and conditions (Nordstorm and Rundgren, 1974) and may ;be because of ecosystem disturbances. Phillipson et at. (1976) showed a significant association between earthworm and ground flora. Lee (1985) recorded extremely high population density of Ocnerodrilidae in sewage inundated area. Earthworm population densities vary in different ecosystems of tropics (Lavelle, 1978). Their population range from 10^{-2} m to several hundreds per square meter in forests, grasslands pastures, crop lands and gardens but occasionally reaching higher number ranging from 500 to 1000^{2} m in forests and pastures having heavy rates of fertilizers (Lee, 1985). Reddy and Alfred (1978) reported population density of earthworm belonging to Megascolicidae and Octochaetidae.

The population density of earthworm in soil is regulated by abiotic and biotic factors over the season (Lee, 1985). Information on population density, dynamics, distribution, biomass, growth and metabolic rate of earthworm is prerequisite to assess the importance of earthworm in an ecosystem.

Madge (1969) and Lavelle et al. (1974) have reported earthworm population of soils of Egypt, Nigerian grass lands and West African Savannas respectively. However, from India only limited information is available (Reddy and Alfred, 1987) from grass land ecosystem of Sambalpur, Bangalore, Madras and Meghalaya. Therefore, the present investigations were aimed to study the dynamics of earthworm population in soil supporting the growth of different woody tree elements.

MATERIALS AND METHODS

The earthworm population under different plantations was recorded. A pit of 25X25 cm^2 was dug up to 30cm depth. The worms were collected and counted at 15cm, 20cm, 25cm and 30cm depths to record population density physical properties of soil was also recorded. The temperature at soil surface and at 10cm depth was recorded. The P^H of the soil was also recorded at respective depths as suggested by Reddy and Alfred (1987).

RESULTS AND DISCUSSION

Perusal of table -1 reveals that the population of earthworm varied both with the season and supporting plant. In the soil supporting the teak, the earthworm population was more during wet season. The population of earthworm gradually decreased with the increase in the depth of the soil. At 15cm depth adults were more than the juveniles and pre-adults were lower in number. During dry season none of them could be detected. At 20cm depth the population decreased to about half. However, pre-adults decreased only marginally. A gradual reduction in the earthworm population from juveniles to adults was recorded as 25cm depth. But at 30cm depth the juveniles were much less than the pre-adults and adults. In contrast to this during dry period earthworms could not be detected at 15cm depth but at subsequent depths they were present in varying number. At 20cm depth adults were more than the pre-adults, while at 25 and 30cm depths pre-adults were more than the adults and juveniles.

Bamboo supported comparatively low population density of earthworms. During wet season the adults were more at 15, 20 and 30cm depth and at 30cm depth the population was minimum. During dry season no earthworm population could be detected at 15cm and 20cm depths. At 25cm depth juveniles were more than pre-adults. At 30cm depth no juveniles and adults could be detected but only pre-adults were detected.

Tamarind tree supported varying population of earthworm with the depth of the soil. At 15cm and 20cm depth juveniles were more, while at 25cm depth the adults and pre-adults dominated. Same was the case at 30cm depth. During dry season the earthworm migrated to deeper layers of the soil. At 15cm depths only juveniles and pre-adults were seen which decreased further at 30cm depth.

Grassland supported more number of earthworms than the deciduous tree soil. The population of earthworm in different layers during wet season was comparatively more. The number of adults decreased with increase in the depth of the soil, while the juveniles increase. During dry season, the earthworm population

decreased significantly upto the depth of 20cm. At subsequent depths the population was high with the wet season but the number of juveniles outnumbered the adults.

In general the soil temperature was more during dry season than the wet season. However, in grasslands the temperature in wet season was comparatively more than the dry season. The temperature of interior soil was less than the surface temperature. Comparatively low number of earthworms in bamboo soil may be due to high temperature. However, in grasslands also the temperature was comparatively more but the population was also more. No correlation could be observed between the temperature of soil and the population of earthworm. The PH of the soil was strongly acidic and it was comparatively uniform in all the soils. However, no correlation could be observed between the moisture content of the soil atmosphere, population and location of earthworm. During wet season the population migrated to the surface of the soil, while during dry season they migrated to deeper layers of the soil. Further, during wet season the adults outnumbered the juveniles.

Table No. 1 Dyanamics of Earthworm Population, temperature and PH of the Soil at different depths

Plantation	Season	Nature of Earthworm	Depth of the Soil (Cms.)				Temperature in Centigrade		P^H in defferent depths of the soil			
			15	20	25	30	Soil surface	10 Cm	15cm	20cm	25cm	30cm
Teak	Wet	Juveniles	9	4	8	5	27	25.6	4.5	4.0	4.5	4.5
		Pre-Adults	6	5	4	12						
		Adults	20	11	3	16						
	Dry	Juveniles	-	7	1	4	28.5	25.5	4.5	4.0	4.5	4.0
		Pre-Adults	-	8	2	7						
		Adults	-	11	1	4						
Bamboo	Wet	Juveniles	4	-	2	2	26.5	26.0	4.5	4.5	4.5	4.5
		Pre-Adults	-	2	2	-						
		Adults	9	6	3	2						
	Dry	Juveniles	-	-	10	-	40.0	32.0	4.0	3.5	4.5	3.5
		Pre-Adults	-	-	3	4						
		Adults	-	-	4	-						
Tamarindus	Wet	Juveniles	16	12	1	4	20.3	20.0	4.0	4.0	4.0	3.5
		Pre-Adults	7	4	17	12						
		Adults	8	2	13	16						
	Dry	Juveniles	6	8	7	6	25.5	25.0	5.0	4.5	4.5	4.0
		Pre-Adults	8	-	5	3						
		Adults	-	-	12	4						
Grassland	Wet	Juveniles	6	8	24	16	30.0	27.5	4.0	4.0	3.5	4.5
		Pre-Adults	8	7	5	14						
		Adults	19	16	12	4						
	Dry	Juveniles	4	8	12	6	25.0	25.0	5.0	4.5	3.0	4.0
		Pre-Adults	2	16	2	4						
		Adults	3	7	2	4						

ACKNOWLEDGEMETNS

Thanks are due to Head, Department of Botany, Kakatiya University and UGC, New Delhi for financial assistance.

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