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RESEARCH ARTICLE

A SURVEY ON THE DIVERSITY AND DISTRIBUTION OF EARTHWORMS IN HIGHER ALTITUDES OF NILGIRIS (TAMILNADU: INDIA) DURING MONSOON SEASONS

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ABSTRACT

Distribution pattern of earthworm fauna in Nilgiris District were studied during North East monsoon and South East monsoons of 2013. The survey was carried out in 26 stations in different elevations ranging from 763 to 2336 meters above msl. 22 Species of earthworms viz., *Allolobophora caliginosa*, *Allolobophora chlorotica*, *Allolobophora rubida*, *Drawida species*, *Drawida grandis*, *Drawida pellucida*, *Drawida naduvattensis*, *Drawida robusta*, *Drawida parva*, *Drawida minuta*, *Drawida modesta*, *Drawida chlorina*, *Eisenia foetida*, *Eisenia rosea*, *Lampito mauritii*, *Lumbricus sp*, *Megascolex imperatrix*, *Megascolex ratus*, *Octolasion cyaneum*, *Perionyx excavatus*, *Perionyx saltans*, *Pheretima sp.* belonging to seven genera and six families were recorded. The distribution of different species of earthworms along the altitudinal gradient is discussed.

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INTRODUCTION

Earthworms are important soil macro fauna that have profound effects on ecosystems. They have attracted a lot of interest due to their beneficial effects, especially in agriculture. Earthworm feeding behavior, burrowing and casting are vital in nutrient cycling and decomposition regulation (Brown, 1995; Dechaine et al., 2005; Larink et al., 2001). Earthworm diversity is influenced largely by soil nutrients and rainfall patterns (Fragoso & Lavelle, 1995). The establishment of earthworm populations in an area, particularly in agricultural soil, is correlated to soil sustainability. Earthworm ecological groups have variable effects on the soil physical, chemical and biological properties (Lee, 1985; Teng et al., 2013). These are one of the major macro-fauna of soil and are considered as unheralded soldiers of the soil. Earthworms have the ability to improve soil structure, contribute to the breakdown of organic matter and release plant nutrients (Edwards and Bohlen, 1996). Earthworms, the soil macro invertebrates, are prominent among soil fauna and regulate the soil processes (Ismail, 1997). They are found in all types of soils with sufficient moisture and food (Ghosh, 1993). They act as decomposers and also a rich protein source (Neuhauser et al., 1979). Belonging to class Oligochaeta, earthworms form the major

terrestrial and soil inhabiting organisms of Phylum Annelida (Ghosh, 1993). In India, Julka (1993) reported 509 species and 67 genera of earthworms. Review of literature reveals that earthworm population dynamics in relation to different soil types is known (Dash & Patra, 1977; Fragoso et al., 1997; Ghosh, 1993). As already mentioned, studies pertaining to the diversity and distribution of earthworm species are scarce in India especially in the Western Ghats. Hence, an attempt has been made by Shylesh Chandran et al. (2012) to conduct a survey of earthworm species available in the Mukurthi peak of Nilgiri biosphere reserve (NBR) and Silent valley to record different earthworm species (both exotic and native) present in various ecosystems. However, no literature is available on the diversity and distribution of earthworms in the altitudinal gradient of Nilgiri District. With this view in mind the present work was planned and carried out to evaluate the distribution of earthworms along the altitudinal gradient and the present availability of earthworms in Nilgiris.

MATERIALS AND METHODS

Collection and identification of earthworms

A survey was conducted in the selected transects of Nilgiris to study the distribution of earthworm species. The locations selected for sampling is presented in Table 1. The surface soil beneath the litter was carefully removed and the earthworm population there was thoroughly observed to find the presence

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of cocoons and earthworms. Simple hand sorting technique was employed to procure earthworms (Sims and Gerard, 1985). The earthworm samples were collected from the below listed areas and transferred to plastic containers and transported to the laboratory. Then the species were identified using standard keys (Bourne, 1886; Stephenson, 1923; Gates, 1940).

Among the different stations surveyed Kanthal (Station.18) had six species of earthworms where 5 species were recorded in College campus (Station.24). The results also reveal that 1130 meters, the diversity of earthworms in lesser (upto 2 species/locality) while in higher elevation the number of earthworm species recorded are high.

Table 1. Location of sampling sites in the present study

S. No.	Location	Latitude	Longitude	Altitude Above M+msl
1.	Baraliar	11°20'36.04"N	76°50'58.67"E	763
2.	Chemmanatham	11°34'08.68"N	76°41'19.78"E	875
3.	Thottamulla, Gudalur	11°30'26.97"N	76°29'48.21"E	913
4.	Masinagudi	11°35'57.58"N	76°38'37.92"E	924
5.	Singara	11°34'56.58"N	76°38'37.90"E	924
6.	Mavanalla	11°33'05.11"N	76°40'28.59"E	927
7.	Vazhithottam	11°31'47.63"N	76°42'15.39"E	968
8.	Bison view	11°29'48.30"N	76°41'21.30"E	1135
9.	Catherine falls	11°23'09.64"N	76°51'16.29"E	1447
10.	Alakkarai	11°23'18.49"N	76°51'33.13"E	1559
11.	Kothagiri	11°23'18.49"N	76°51'33.13"E	1559
12.	Kallaty falls	11°28'38.93"N	76°40'55.79"E	1608
13.	Lambs rock	11°21'13.66"N	75°50'14.23"E	1734
14.	Coonoor	11°21'03.09"N	76°47'26.13"E	1782
15.	Naduvattam	11°28'44.89"N	76°32'38.10"E	1843
16.	Pykara	11°27'37.49"N	76°36'55.88"E	2161
17.	Thalaikuntha	11°26'40.98"N	76°40'14.89"E	2163
18.	Kanthal	11°24'32.10"N	76°41'02.91"E	2220
19.	Thoda colony	11°25'36.99"N	76°40'35.75"E	2236
20.	Butfire	11°25'37.18"N	76°40'35.60"E	2237
21.	Kodapmanth	11°24'54.13"N	76°42'54.91"E	2239
22.	Kulisholai	11°25'32.57"N	76°40'45.43"E	2251
23.	Governersholai	11°24'08.36"N	76°39'36.96"E	2251
24.	College campus	11°24'44.43"N	76°42'42.88"E	2260
25.	Avalanchi	11°17'50.74"N	76°34'26.30"E	2301
26.	Forest gate	11°25'33.64"N	76°42'14.78"E	2336

RESULTS AND DISCUSSION

The earthworm species identified from various study area in the Nilgiris are given in Table 1. The overall findings showed that samples from the NBR had higher number of native earthworm species. This is an indication that their habitat is less disturbed, because as stated in the literature, habitat alteration/disturbance leads to the invasion of exotic species (Bhadoria and Saxena 2007). This study resulted in the identification of five different families (Acanthodrilidae, Megascolecidae, Moniligastridae, Glossoscolecidae and Octochaetidae) and Twenty two Species different species of earthworms from the study area. The number of earthworms recorded in Kanthal was comparatively less than that in other sites.

The higher degree of diversity of earthworms in the higher altitudes may be due to the low temperature, high humidity and higher rainfall rate in the higher elevation of upper Nilgiris. Further Table 3 reveals that *Allolobophora caliginosa*, *Allolobophora chlorotica*, *Allolobophora rubida*, *Drawida species*, *Drawida grandis*, *Drawida pellucida*, *Drawida naduvattensis*, *Drawida robusta*, *Drawida parva*, *Drawida minuta*, *Drawida modesta*, *Drawida chlorine*, *Eisenia foetida*, *Eisenia rosea*, *Lampito mauritii*, *Lumbricus sp*, *Megascolex imperatrix*, *Megascolex ratus*, *Octolasion cyaneum*, *Perionyx excavatus*, *Perionyx saltans*, *Pheretima sp*. Species are restricted to lower elevation (upto *Eisenia foetida*, *Lampito mauritii* *Perionyx excavatus*, meters) and higher found in higher elevation above *Eisenia rosea*, *Drawida grandis*,

Table 2. Distribution the Species of Earthworms in Nilgiris

S. No.	Location	Altitude M+msl	Species recorded
1.	Baraliar	763	<i>Eisenia foetida</i>
2.	Chemmanatham	875	<i>Lampito mauritii</i>
3.	Thottamulla, Gudalur	913	<i>Lumbricus sp.</i>
4.	Masinagudi	924	<i>Lampito mauritii</i> <i>Eisenia foetida</i>
5.	Singara river	924	<i>Lampito mauritii</i>
6.	Mavanalla	927	<i>Lampito mauritii</i>
7.	Vazhithottam	968	<i>Lampito mauritii</i>
8.	Bison view	1135	<i>Lampito mauritii</i>
9.	Catherine falls	1447	<i>Perionyx excavatus</i>
10.	Alakkarai	1559	<i>Drawida pellucida</i>
11.	Kothagiri	1559	<i>Eisenia rosea</i> <i>Eisenia foetida</i>
12.	Kallaty falls	1608	<i>Allolobophora caliginosa</i>
13.	Lambs rock	1734	<i>Drawida grandis</i> <i>Drawida pellucida</i>

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14.	Coonoor	1782	<i>Megascolex imperatrix</i> <i>Drawida grandis</i> <i>Drawida pellucida</i>
15.	Naduvattam	1843	<i>Perionyx excavatus</i> <i>Perionyx excavatus</i> <i>Eisenia rosea</i> <i>Drawida naduvattemensis</i>
16.	Pykara	2161	<i>Eisenia rosea</i> <i>Octolasion cyaneum</i> <i>Allolobophora rubida</i> <i>Drawida robusta</i> <i>Drawida parva</i>
17.	Thalaikuntha	2163	<i>Allolobophora caliginosa</i>
18.	Kanthal	2220	<i>Perionyx excavatus</i> <i>Allolobophora chlorotica</i> <i>Perionyx saltans</i> <i>Drawida robusta</i> <i>Pheretima sp.</i> <i>Allolobophora rubida</i>
19.	Thoda colony	2236	<i>Eisenia foetida</i> <i>Drawida robusta</i> <i>Drawida parva</i>
20.	Butfire	2237	<i>Drawida grandis</i> <i>Allolobophora chlorotica</i> <i>Pheretima sp.</i> <i>Drawida minuta</i>
21.	Kodapmanth	2239	<i>Eisenia foetida</i>
22.	Kulisholai	2251	<i>Drawida grandis</i> <i>Eisenia foetida</i> <i>Pheretima sp.</i>
23.	Governer shola	2251	<i>Perionyx excavatus</i> <i>Drawida pellucida</i> <i>Drawida species</i> <i>Drawida minuta</i>
24.	College campus	2260	<i>Octolasion cyaneum</i> <i>Pheretima sp.</i> <i>Perionyx excavates</i> <i>Drawida grandis</i> <i>Eisenia foetida</i>
25.	Avalanchi	2301	<i>Megascolex ratus</i> <i>Drawida pellucida</i> <i>Perionyx saltans</i> <i>Drawida modesta</i>
26.	Forest gate	2336	<i>Allophora caliginosa</i> <i>Perionyx excavatus</i> <i>Drawida chlorina</i> <i>Drawida minuta</i>

Table 3. Distribution of earthworm species in different altitudes

S. No	Species	No of locations	Altitude (m above msl)	
			From	to
1.	<i>Allolobophora caliginosa</i>	3	1608	2336
2.	<i>Allolobophora chlorotica</i>	2	2220	2237
3.	<i>Allolobophora rubida</i>	2	1782	2161
4.	<i>Drawida species</i>	1	2251	
5.	<i>Drawida grandis</i>	4	1734	2260
6.	<i>Drawida pellucida</i>	4	1559	2301
7.	<i>Drawida naduvattemensis</i>	1	1843	
8.	<i>Drawida robusta</i>	3	2161	2236
9.	<i>Drawida parva</i>	1	2161	
10.	<i>Drawida minuta</i>	3	2237	2336
11.	<i>Drawida modesta</i>	1	2301	
12.	<i>Drawida chlorina</i>	1	2336	
13.	<i>Eisenia foetida</i>	1	763	2260
14.	<i>Eisenia rosea</i>	3	1559	2301
15.	<i>Lampito mauritii</i>	6	875	1135
16.	<i>Lumbricus sp.</i>	1	913	
17.	<i>Megascolex imperatrix</i>	1	1782	
18.	<i>Megascolex ratus</i>	1	2301	
19.	<i>Octolasion cyaneum</i>	2	2161	2260
20.	<i>Perionyx excavatus</i>	7	1447	2336
21.	<i>Perionyx saltans</i>	2	2220	2301
22.	<i>Pheretima sp.</i>	4	2220	2260

Drawida pellucida, *Drawida naduvattensis*, *Megascolex imperatrix*, *Megascolex ratus*. respectively these earthworms are found restricted in this zone and found endemic, the studies relationship to the environmental factors associated with the distribution of these species in further needed. How ever of is assumed that the low temperature as well as high humidity and rain fall in this zone may be reason. Further, the undistributed areas with low pollution load of pesticide may be another reason for more diversity of earthworms in the locality. The elevation around 1843 m above msl is a transition zone from tropical deciduous forest to sholas grass land patches. This may be with peculiar ecological characteristics. Hence there endemic earthworms survive and perform this altitudes. Further the species *Drawida naduvattensis*, *Megascolex imperatrix*, *Megascolex ratus*, *Drawida chlorine*, *Drawida minuta*, in the paper is a rediscovery after Stephenson (1923).

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