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THE DISTRIBUTION OF INDIGENOUS *LAMPITO MAURITII* (KINBERG) AND *EXOTIC EUDRILUS EUGENIAE* (KINBERG) EARTHWORM SPECIES IN BALLARI DISTRICT, KARNATAKA, INDIA.

Zoology

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ABSTRACT

Earthworm survey was conducted in the selected habitats of Ballari district.The collection were made from following ecological niche during the month of June –October (2019) by adapting digging and handsorting method. The exotic earthworms now occur in every other biogeographic region along with native species. The distribution of such peregrine species is widespread from local to global scales. In our study *Eudrilus eugeniae* (exotic) and *Lampito mauritii* (indigenous) were found naturally in the Ballari district. These earthworms belongs to the family Eudrilidae and Megascolecidae respectively. Some places were dominated by particular earthworm species and in some places they were not found at all. There are number of internal and external factors that are involved for the successful establishment and spread of peregrine species.Geographical region, climatic condition and disturbances in habitat,succession of intensive agriculture practices and manmade canal system,the manipulation of natural habitat by anthropogenic activities has resulted into displacement of earthworm species and their dominancy. One of the reason for the species abundace is soil charecterstics in our studies soil charecterstics ranges as follows pH 6.3 to 8.8, electrical conductivity (EC) 0.4 to 3.60 mohs/cm, Organic carbon (OC) 0.41 to 2.81%, Phosphorous (P) 10.9 to 71.9 kg/acre and Potassium (K) 85 to 451 kg/acre. Both the species were highly found near gutter, garbage and near tap water and Least number were found in pasture and grassland.

KEYWORDS

Ballari, Distribution, Earthworms, Exotic, Indigenous.

INTRODUCTION

Earthworms are considered as "Engineers of ecosystem" as they play a crucial role in formation of soil and recycling of nutrients (Blouin *et al*., 2013). As a result feeding and burrowing habits (Baker, 2007) of earthworms, functions like waste decomposition, nitrogen mineralisation from organic matter and water percolation also takes place. Hence deeply affects soil properties (Hattenschwiler and Gasser, 2005).

As far as earthworm diversity is concerned, India is one of the rich countries . As many as 505 species and 67 genera (Kathireswari, 2016) of earthworms are known from the Country. Both physical factor and nature of organic matter of soil have been known to influence the abundance and distribution of earthworms. Soil, water content and mineral matter are the major physical factors affecting the distribution of the earthworms. However, the nature of organic matter influence in the distributions are not clearly elucidated. The casual factor for differentiation might be seen in the nature of available organic matter in the area.However, compare to population density of a particular species is not at all related to the total organic matter content of the soil in other words the nature of the organic matter influences the abundance and species diversity of the earthworms (Kale and Krishnamoorthy,1981). Little information is available about the distribution of *Eudrilus eugeniae* and *Lampito mauritii* earthworms of Ballari district. So, the present survey therefore undertaken to study detailed distribution of *Eudrilus eugeniae* and *Lampito mauritii* earthworms up to Grama Panchayat level.

MATERIALS AND METHODS

Ballari district (fig.1) is one of the districts in Karnataka state. Covering an area of 8420sq kms, it lies between 15° 30' - 15°50' North latitude and 75° 40' - 77° 11' East longitude and elevation at 461 MSL.The normal rainfall is 639 mm. Climate of the district is hot with temperatures exceeding normally 40° C. Bellary is mostly semi-arid and is in fact arid. The district lying at the transition between red soil and black soil region, presents a mixture of red and black soils.

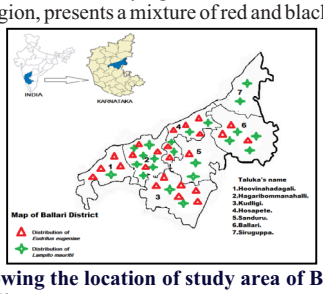

Fig.1; Map showing the location of study area of Ballari District, Karnataka, India.

The collection were made from following ecological niche which includes litter, garbage, margins of freshwater bodies, pastures, grasslands, irrigated fields, etc. The best method for collecting earthworms is by digging and hand sorting method (Julka, 1988). Marphological characteristics like length, diameter, body colour of earthworms were noted down. The collected earthworms were fixed in 10% formalin solution (Julka and Paliwal, 1993) and preserved earthworm specimens were identified using key charts (Gates 1972; Julka 1988) in the laboratory and reconfirmed by Zoological survey of India, Kolkata. Habitat soil samples of earthworms habitats were collected for its physicochemical analysis like pH, electrical conductivity, organic carbon, phosphorous, potassium. Soil analysis was carried out at Agriculture Soil testing laboratory, Kalburgi.

RESULTS

In our suvey earthworms were collected from 45 spots in different habitats. The earthworms *Eudrilus eugeniae* and *Lampito mauritii* belongs to the family Eudrilidae and Megascolecidae respectively.

Table.1; Morpholgical charecters of the Eudrilus eugeniae and Lampito mauritii.

1. Name of the species	*Eudrilus eugeniae* (Kinberg, 1867)	*Lampito mauritii* (Kinberg, 1867)
2. Body colour	Dark purple	Brownish
3. Body length (mm)	90-185 mm.	80-150 mm.
4. Body diameter (mm)	4-7.5 mm.	3.5-4.5mm
5. No. of segments	165-215	85-165
6. Prostomium	Open epilobous	Prolobic
7. Setal arrangement	Lumbricine	Perichaetine
8. The position of first dorsal pores	Absent.	13/14
9. Penial/genital setae	Absent	Present
10. Clitellum	13, 14-18thsegment	14-17th segment
11. Female pores	Combined with modified spermathecal pores lateral,in 14th	Paired ,14th segment.
12. Gizzard number and position.	Single gizzard in 5th segment	Single gizzard in 5th segment
13. Number of calciferous glands.	Two pairs,10thand 11th segment	No calciferous glands.
14. Last pair of hearts	11th segment	13th segment
15. Beginning of intestine	14th segment	15th segment
16. Intestinal caeca	Absent	Absent
17. Typhlosole	Absent.	Absent.
18. Number of seminal vesicles and position	Paired, 9th and 12th segment.	Paired, 11th and 12th segment.

Table 2: Details of the distribution of *Eudrilus eugeniae* and Habitat soil analysis.

Sl.No	TALUKA	AREA	LOCATION	HABITAT	pH	EC (mohs/cm)	OC (%)	P (Kg/acre)	K (Kg/acre)
1	Hagaribommanahalli	Hosakere	N14°59'22" E76°18'35"	Gutter	7.8	0.8	1.62	41.8	255
2		Thambralli	N15°06'42" E76°11'06"	Water tap	7.6	1.0	1.79	36.3	224
3		Mutukuru	N15°12'34" E76°10'52"	Gutter	8.1	1.9	1.35	39.3	180
4		Krishnapura camp	N15°09'20" E76°07'22"	Garbage	8.1	2.0	1.49	71.9	231
5	Hosapete	82- Danapura	N15°10'39" E76°25'51"	Garbage	6.4	1.9	1.29	50.7	240
6		Kakubalu	N15°62'42" E77°15'07"	Gutter	7.9	0.8	1.95	37.6	171
7		Narasapura	N15°20'02" E76°25'02"	Garbage	7.6	0.6	1.60	19.4	97
8		Hosapete	N15°17'42" E76°20'7"	Garbage	8.4	0.7	0.41	18.1	198
9		Nandibandi	N15°22'4" E76°30'7"	Garbage	7.8	0.5	1.68	28.7	99
10	Ballari	Dammuru	N15°20'56" E76°55'49"	Gutter	7.4	0.26	1.68	14.1	198
11		Horalgundi	N15°15'50" E76°57'52"	Garbage	8.3	0.33	1.52	16.0	489
12		Chanaal	N14°57'12" E76°5'23"	Gutter	8.0	0.38	1.32	27.1	282
13	Hoovinahadagali	Uttangi	N14°59'22" E76°02'30"	Garbage	7.0	0.85	1.89	13.8	451
14		Adavimalikeri	N14°54'58" E76°00'41"	Garbage	6.9	1.58	2.10	21.3	389
15		Muddenuru	N14°59'52" E75°58'18"	Garbage	6.6	0.22	1.76	14.6	208
16		Allipur	N14°59'47" E75°51'23"	Garbage	7.1	0.84	2.07	10.4	405
17	Sanduru	Nidugarti	N15°01'03" E76°25'38"	Garbage	7.2	1.87	0.94	20.4	313
18	Kudligi	Sivapura	N14°57'28" E76°21'51"	Gutter	8.8	2.54	2.67	21.8	327
19		Kudligi	N14°54'41" E76°22'44"	Gutter	6.4	1.04	2.81	22.0	289
20		Bellighatti	N14°48'09" E76°31'49"	Water tap	8.3	1.75	1.78	13.4	209
21		Igala mallapura	N14°49'33" E76°24'14"	Gutter	8.8	0.63	1.23	35.0	236
22		Chowdapura	N14°49'03" E75°51'23"	Gutter	6.3	3.50	2.97	38.7	318
23		Badaladaku	N14°52'12" E76°21'28"	Garbage	7.3	0.79	1.94	42.0	258

Table 3: Details of the distribution of *Lampito mauritii* and Habitat soil analysis.

Sl No.	TALUKA	AREA	LOCATION	HABITAT	pH	EC (mohs/cm)	OC (%)	P (Kg/acre)	K (Kg/acre)
1	Hagaribommanahalli	Pinjarahegadala	N15°5'47" E76°14'18"	Gutter	8.2	0.4	0.74	10.9	152
2		Hagarikyadigeri	N15°09'47" E76°14'09"	Water tap	7.4	1.3	1.38	40.6	152
3		Thambralli	N15°06'42" E76°11'06"	Gutter	7.8	1.0	1.71	34.2	180
4		Bannigola	N15°10'11" E76°08'11"	Pasture	7.9	1.3	1.32	38.4	244
5		Yenagi	N15°06'50" E76°05'42"	Garbage	7.2	1.9	0.93	38.0	192
6		Bannikaal	N15°09'20" E76°07'22"	Water tap	8.0	1.7	1.82	28.3	281
7		Hansi	N14°56'59" E76°18'16"	Garbage	7.8	0.6	1.71	19.0	127
8	Hosapete	Talebassapura	N16°07'42" E77°02'07"	Pasture	7.4	0.5	1.04	38.0	130
9		Chilakanahatti	N15°14'05" E76° 37'57"	Water tap	7.6	0.9	0.78	30.1	85
10		Kallali	N15°15'59" E76°20'27"	Garbage	7.5	1.4	1.21	63.4	141
11		Ramasagara	N15°14'44" E76°20'27"	Garbage	7.4	1.1	3.31	63.4	93
12	Ballari	Kotaginahalu	N15°25'40" E76°44'38"	Gutter	7.2	0.7	1.07	10.9	118
13		Nelludi	N15° 12'10" E76°25'41"	Garbage	7.4	0.45	1.79	26.0	375
14		Handihalu	N14°57'12" E76° 05'23"	Gutter	8.0	0.5	1.49	31.7	166
15		Sridharagadda	N15°21'08" E76°34'49"	Grassland	7.3	1.0	1.10	40.6	99
16	Hoovinahadagali	Bavihalli	N15°04'36" E76°00'36"	Pasture	7.4	0.41	1.78	51.0	423
17	Sanduru	Katinakamba	N15°00'14" E76°02'26'00"	Grassland	6.7	2.38	2.43	11.2	289
18		Bandri	N15°59'24" E76°27'41"	Pasture	7.4	3.60	1.64	46.0	333
19	Kudligi	Narasimhagiri	N14°47'56" E76° 31'08"	Water tap	7.9	0.73	1.16	40.0	242
20		Echalabommanahalli	N14°53'40" E76°21'09"	Grassland	7.5	0.87	1.99	53.0	362
21	Siruguppa	Rudrapada	N15°28'50" E76°24'14"	Water tap	7.3	0.58	1.99	73.0	403
22		Kenchanagudda	N15°36'48" E76°47'17"	Grassland	7.7	0.43	1.34	43.0	132

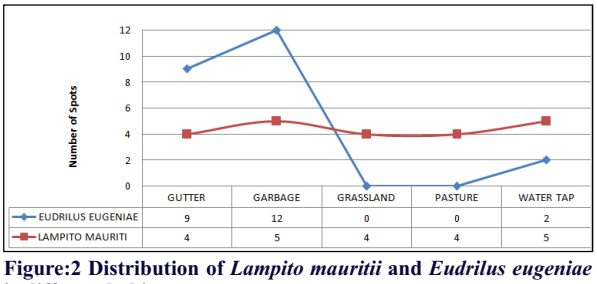

Figure:2 Distribution of *Lampito mauritii* and *Eudrilus eugeniae* in different habitats.

The details of the collected localities are listed in the(table 2 and 3). One of the reason for the species abundace is soil charecterstics which ranges as follows pH 6.3 to 8.8, (EC) 0.4 to 3.60 mohs/cm, (OC) 0.41 to 2.81%, (P) 10.9 to 71.9 kg/acre and (K) 85 to 451 kg/acre. The occurrence of *Eudrilus eugeniae* was high in sewage soil when compared to other pedoecosystems. Their number is highest in the gutter, garbage and followed by near water tap (fig.2). *Eudrilus eugeniae* was not found in pasture, grass lands. Abundance and availability chances of this species vary according to different habitats. Where as the *Lampito mauritii* was found from all the selected habitats (fig.2). This shows it is widely adapted for all type of habitat conditions.

In our studies it was also observed species association with other earthworm species. In Thambralli *Eudrillus eugeniae* found along with *Perionyx* species, in Badeladaku *Eudrilus eugeniae* and *Thatonia* species found together. Similarly *Lampito mauritii* found in association with *Octochaeona paliensis* and *Octochaeona suriensis* in Thambralli and Bannigola places respectively. It is also noted that few places were dominated by *Eudrilus eugeniae* and few by *Lampito mauritii* this is may be beacause owing to geographical region, climatic condition and disturbances in habitat ,succession of intensive agriculture practices and manmade canal system,the manipulation of natural habitat by anthropogenic activities has resulted into displacement of earthworm species and their dominancy.

DISCUSSION

Although earthworms have limited power of dispersal a few species

are ubiquitous(widespread distribution). Dispersal of some species of earthworms is man made, either accidentally or deliberately further their adaptability to the various soil types and climatic condition has made them persistent fauna.Reports also suggest that their habits such as geophagy and breeding enable them to colonize easily. Among the Megascolecidae, *Lampito mauritii* although has a wide range of distribution. The presence of these species in particular habitats shows the specific habitat preference of these worms (Singh,1997; Tripathi and Bhardwaj, 2004).

Eudrilus Eugeniae reported from Hyderabad- Karnataka region, India. (Mubeen and Hatti, 2018). From different habitats of Southern Odisha ,India by (Sankar and Patnaik, 2018). From Kerala state by (Narayana *et al* ,2012), in Pondicherry region reported by (Sathianarayanan, Khan and Anisa, 2006). *Lampito mauritii* was also reported from 8 different blocks of Sivagangi district, Tamilnadu (Paul , 2017). It was also reported from grass land habitat of Aligarh District, Uttar Pradesh state (Om prakash, 2017), from South paragana district in West Bengal by (Goswami and Mondal, 2015), It was also reported from trans gangetic habitats of Haryana by (Sharma and Poonam, 2014).

The association of earthworms species sharing the same habitat is not uncommon.This type species association is reported by Mubeen and Shankerappa (2018) *Eudrillus eugeniae* was found along with *Octochaetona parva*. In our studies aswell, in Badeladaku *Eudrilus eugeniae* and *Thatonia* species found together . The spread of *Eudrilus eugeniae* may require closer monitoring as it is a widely cultivated species in this region too and there are some records of its survival away from worm farms, mainly in areas of high organic matter, but also in gardens and fields. It was also collected from waterfalls and river sites in Guadeloupe (Csuzdi & Pavlicek 2009).

The report suggests that when *Lampito mauritii* occurs in association with other species it fails to establish its dominance perhaps because of their metabolic rate when co-existing with other species (Kale,1981). It was observed in our studies as well *Lampito maruitii* was found in association with *Octochaeona paliensis* and *Octochaeona suriensis* only, in rest of the spots it was not in association with any other species.

All the species were found in the moist damp places in the edges of the standing water where nutrient supply was richly available (Tripathi and Bharadwaj, 2004). One of the reason for the species abundace is soil charecterstics which ranges The majority of species are in distribution range between pH of 6.0 and 7.8 (Sankar and Patnaik, 2018) this shown in our studies aswell with pH 6.3 to 8.8.

CONCLUSION

To conclude *Eudrilus eugeniae* and *Lampito mauritii* is distributed naturally all over Ballari region. By adopting different methods vermitechnology using local earthworm species it is possible to produce the organic manure. When it comes to production of vermicompost ideal species of earthworm help to convert waste into wealth. If this operation is made successful by the efforts of the farming community one can certainly be hopeful of converting the waste land into a fertile land. This may help in reaching the goal of green revolution from different angle.

Conflicts of interest: The authors declare that there is no conflicts of interest.

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