

EARTHWORM DIVERSITY IN JHARKHAND STATE

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ABSTRACT

The present communication reports for the first time the earthworm diversity based on extensive sampling and survey during last couple of years in Jharkhand state. More than eleven dominant earthworm species have been recorded apart from few more of occasional occurrence. The most common species are *P. coreus samachensis* (Michaelsen), *Hellogaster affinis* (Michaelsen), *Hellogaster longipennis* (Michaelsen), *Platystrophia patana* (Vulliamy), *Urodele rufi* (Michaelsen), *Lumbricoides occidentalis* (Fierst), *Enchytraeus colata* (Fierst), *Lumbricus nebulosus* (Kimber), *Ammonia* sp. (Michaelsen), *Glyptodermis* sp. (Fierst) and *Pheretima phanua* (Watas). The earthworm biodiversity is modified when one natural ecosystem is transformed into another, say grassland or savanna into agroecosystem. The functional approach has been taken into account, i.e. the ecological groups like epigeic, endogeic and anecic while considering the earthworm biodiversity during the present work. In general, the disturbed ecosystems, i.e. agroecosystems, have lower population density, lower species richness and lower number of ecological groups with a predominance of endogeics. Epigeic and anecic species have not been found to be widespread in agricultural ecosystems of Jharkhand state. The epigeic and anecic groups are dominant in areas having high litter content. The earthworm diversity has also been viewed from biogeographical basis.

INTRODUCTION

Earthworms are invertebrates belonging to the phylum Annelida and class Oligochaeta. The ecology and biology of earthworms have been studied since Darwin's contribution to the study of earthworms in 1881. Distribution of earthworms is usually irregular (Guild 1952, Satchell 1955, Svendsen 1957), the numbers vary in relation to the type of soil (Ejvars & Guild 1947) and ecological factors especially edaphic factors (moisture and temperature).

The first records of earthworms from the Indian subcontinent were provided by Tompkinson (1844). Subsequently, several species were added by various workers notably Michaelsen (1907), Stephenson (1923, 1924, 1925, 1926, 1931), Gates (1940, 1945a, 1945b, 1972), Julka (1976, 1978, 1981), Julka & Senapati (1987), Datta & Kala (1991) and Singh & Rai (1997). At present, the Indian earthworm fauna comprises of about 500 species placed in 10 families and 58 genera (Dash 1999). Thirty-eight genera are endemic on main land and 20 are peregrine that have been introduced to this region presumably in soil around the roots of exotic plants.

Despite the fact that there are about 500 species in India, the field of earthworm study has not achieved any attention in the state of Jharkhand, Bihar and Chhatisgarh. For the first time 11 earthworm species belonging to 5 families and 8 genera have been identified while a sizeable number of species are still under observation for identification.

On the basis of size and habitat, the Oligochaetes are often divided into two convenient groups: Microdrili (small, mainly aquatic worms) and Megadrili (larger, mostly terrestrial worms and their

aquatic representatives). The present communication records for the first time the eleven species of earthworms collected from different places of Jharkhand and deals with different aspects of earthworm diversity in the state. Earthworms were sampled from different spots from different districts of Jharkhand and different habitats during the period of two years 1999-2001. The monolith method of earthworm sampling was followed as per Dash & Patra (1977).

OBSERVATIONS AND DISCUSSION

Taxonomic Earthworm Diversity in Jharkhand

At present 11 species of earthworm namely *Pheretima samshariae* (Michaelson), *Dichogaster affinis* (Michaelson), *Pallidogaster bengalensis* (Michaelson), *Pheretima postuma* (Valliant), *Draconida willii* (Michaelson), *Oenoneuritis occidentalis* (Eisen), *Draconida culveri* (Gates), *Lumbrico moorii* (Kimberg), *Draconida* sp. (Michaelson), *Glyphisdrilus* sp. (Jorst), *Pheretima planata* (Gates) have been identified belonging to 5 families and 8 genera (Table 1) on basis of the key.

BIOGEOGRAPHY

Earthworms are of particular biogeographical interest since the means of dispersal available to them are restricted; their mobility is limited to small areas at all stages of their life cycle; they are unable to survive prolonged desiccation or exposure to sunlight, and many species are killed by even brief immersion in sea water. However, some species that are capable of adaptation to a wide range of habitats have been spread over large areas of the world with plants and soil transported by Man, and it seems likely that most, not all but some earthworms of Jharkhand may have been introduced in this way.

Thus, from the point of view of earthworm biogeography, species richness of a given site is constituted by two groups of earthworms, native and exotic species. The first category comprises species that evolved in the site or region under study. Although some of these species have been able to survive in disturbed ecosystems,

Table 3. Peregrine earthworm genera and species of Jharkhand

Family/Genera	Species
Megascollecidae	
<i>Pheretima</i>	<i>Pheretima planata</i> <i>Pheretima postuma</i>
Oenoneuritidae	
<i>Oenoneuritis</i>	<i>O. occidentalis</i>
Dracocheilidae	
<i>Dichogaster</i>	<i>Dichogaster affinis</i>

Table 1. Earthworm genera and species known from Jharkhand.

Family/Genera	No. of sp. from Jharkhand	No. of sp. from India
Almidae		
<i>Glyphisdrilus</i>	1	4
Megascollecidae		
<i>Lumbrico</i>	1	7
<i>Pheretima</i>	1	9
<i>Pheretima</i>	1	17
Mouliigastricidae		
<i>Draconida</i>	3	62
Oenoneuritidae		
<i>Oenoneuritis</i>	1	1
Dracocheilidae		
<i>Dichogaster</i>	1	5
<i>Dichogaster</i>	1	2

mainly restricted to natural ecosystems (forests, natural savannas). The majority of the presently known species belong to this group. If in future the present rates of deforestation are maintained, massive extinction of native species can be anticipated, especially since endemism appears to be common for many native earthworm species (Fragoso et al. 1995).

The group of exotic species includes earthworms introduced by human activities. They have also been called peregrine (Lee 1985, 1987) and anthropochorous (Gates 1970) species. This group of species can tolerate a wide range of soil and environmental conditions, they have been often com-

Table 3. Endemic earthworm genera and species of Jharkhand

Family	Restricted to India	Extra Indian distribution
Nereidae	-	<i>Glyphidrilus</i>
Megascollecidae	<i>Lampito</i> <i>Lampito acuminata</i>	<i>Perionyx</i> <i>Perionyx sahilensis</i>
Murchieidae	-	<i>Travida</i> <i>Travida</i> sp. <i>Travida ciliata</i> <i>Travida villosa</i>
Octochaetidae	<i>Pellagaster</i> <i>Pellagaster f. angulatus</i>	-

shown in Table 2. The peregrine species being *Pheretima posthuma*, *Pheretima planata*, *Oenonodrilus occidentalis* and *Dichogaster affinis*. Table 3 lists endemic genera in Jharkhand of which 2 have exclusively Indian and 3 have extra Indian distribution.

Classification Based on Ecology

Evans and Guild (1967) distinguished earthworms into surface dwelling and deep dwelling forms. Byzova (1965) was the first to distinguish surface living smaller worms with high metabolic rate from deep dwelling larger worms with less metabolic rate. Bouche (1977) proposed an ecological classification of earthworms into 3 generalised life forms.

- i. **Epigees** - litter or dung dweller, tolerant to disturbances, high rate of cocoon production and short life cycle, body size small, deeply pigmented.
- ii. **Endogeas** - Dwellers of top soil, rich in organic matter, tolerant to some disturbances, moderate to a high rate of cocoon production, light pigmented.
- iii. **Aneciques** - Deep soil dwellers, intolerant to disturbances, low rate of cocoon production, long life cycle, body size large and unpigmented or light pigmented.

The details of characteristics of ecology-based classification have been presented in Table 4.

Table 4. Summary of characteristics used by Bouche (1977) to distinguish ecological type of earthworms (after Dash and Sarapani 1986)

Character	Ecological type		
	Epigeas	Endogeas	Aneciques
Body size	Small	Moderate	Large
Burrowing muscles	Reduced	Strongly developed	Developed
Longitudinal contraction	Nil	Developed	Least developed
Hooked chaetae	Absent	Present	Absent
Sensitivity to light	Feeble	Moderate	Strong
Mobility	Rapid	Moderate	Feeble
Skin resistance	Developed	Developed	Feeble
Pigmentation	Chromatropic	Dorsal and anterior	Absent
Fecundity	High	Moderate	Limited
Maturation	Rapid	Moderate	Slow
Respiration	High	Lowest	Feeble
Survival of adverse conditions	As anecis	True diapause	By quiescence

considered as the predominant earthworm fauna in anthropic tropical ecosystems, and also to be important in maintaining the fertility of agricultural and pastoral lands (Lee 1987). Less than 1% of the total numbers of earthworms described are tropical exotic species.

In the present investigation peregrine genera are distributed among 3 families namely Megascollecidae, Oenonodrilidae and Octochaetidae as

Table 5: Three proposed reclassifications of family Megascotolecidae (Stephenson's, 1950).

Gates (1959)	Omodeo (1958)	Lee (1959)
FAMILY: MEGASCOLECTIDAE Prostates tubular (necessitate)	FAMILY: MEGASCOLECTIDAE Prostates tubular (necessitate)	FAMILY: MEGASCOLECTIDAE as Stephenson (1950)
FAMILY: ACANTHODRILIDAE Prostates tubular Calciferous glands not in segment 9 or 9 and 10 Excretory system metanephridial	FAMILY: ACANTHODRILIDAE Prostates tubular Subfamily: Oenodrilinae Calciferous glands in segment 9 or segments 9 and 10	Subfamily: Megascotolecinae One pair of prostatic pores combined with or in addition to one pair of male pores on segment 13
FAMILY: OCTOCHAETIDAE Prostates tubular Calciferous glands not in segment 9 or 9 and 10 Excretory system metanephridial	Subfamily proposed Calciferous glands absent Subfamily proposed Simple calciferous glands in segments 10-13	Subfamily: Acanthodrilinae One pair of prostatic pores on segments 16, 17 or 19 or two pairs on segments 17 and 19 <i>Tribe: Noodrilinae</i> Excretory system metanephridial Nephridia of two series alternating in position in successive segments
FAMILY: OENODRILIDAE Prostates tubular Calciferous glands in segments 9 or 9 and 10	Subfamily proposed Simple calciferous glands in segments 14-17 Subfamily: Beuthaninae Calciferous glands stalked and laminate	<i>Tribe: Acanthodrilinae</i> Excretory system metanephridial with nephridia of a single series on each side of the body or excretory system metanephridial

Earthworms may also be clearly divided into detritivores, that feed at or near the soil surface mainly on plant litter or dead roots and other plant debris in the organic matter rich surface soil horizons or on mammalian dung, and geophages, that feed in deeper layer beneath the surface ingesting large quantities of soil usually selecting portion with higher than normal organic matter content. The group that comprises detritivorous earthworms is more or less equivalent to the humus formers and geophagous species to humus feeders, the two principal mesopanelogical categories of earthworms recognized by Perel (1977).

Systematics

A systematic account and ecological as well as biological observations on the earthworms of Harikhand have been presented. For a detailed synonymy of the species, the works of Gates (1972) and Julka (1976, 1978) may be referred. In this work the classification of Oligochaeta into orders and suborders, as proposed by Brinkhurst and Jamieson (1971) and the division of the suborder Lumbricina into super families and families as given by Sims (1980), have been followed.

Earthworms of family Megascotolecidae are most widely distributed. This family has 30 genera, of which *Pheretima* is the largest with 14 species. The classification of the megascotolecid earthworms has always been more controversial than that of other oligochaeta families. In recent years three new systems of classification have been proposed, those are by Omodeo (1958), Gates (1959) and Lee (1959). These classificatory schemes given in Table 5 replace that of Stephenson (1950).

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