



## Taxonomical Studies on Earthworm Species of Gulbarga City, Karnataka, India

### KEYWORDS

Earthworms, Taxonomy, Gulbarga City

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**ABSTRACT** Earthworms are very important organisms of soil they are called friend of the farmer. They are important environmentally and economically so that their identification and classification is very essential. Taxonomy aims to classify organisms based on their similarities and differences. The present study was carried out during 2011 and 2012 at Gulbarga University Gulbarga focusing on identification and classification of local species of earthworm. The earthworms were collected and preserved and then carefully examined in the laboratory. Three species of earthworms were identified based on their external morphology and internal anatomy with monograph and books. The earthworms identified are belonging to two families namely Megascolecidae and Octochaetidae. *Polypheretima elongata* and *Perionyx sansibaricus* belong to family Megascolecidae and *Dichogaster bolau* belong to family Octochaetidae.

### INTRODUCTION:

Earthworms (known generally by common names as dew worms, rain worms, night crawlers, angle worms and Kechua in India and in Karnataka particularly by Erehulu, Julujuli, Nainalige, etc.) are important biological resources that have tremendous potentials in agro-ecosystems because they significantly affect soil physical structure and organic matter dynamics and promote plant growth (Lee, 1985; Lavelle et al., 1988). India is a large country harboring a very high diversity of earthworms, mostly concentrated in Western Ghats and Eastern Himalayas.

Tripathi and Bhardwaj (2005) reported on the biodiversity of arid zone of Jodhpur district of Rajasthan. A total of nine species of earthworms are recorded from different pedoecosystems of desert environment. They are *Pontoscolex corethrusus*, *Amyntas morrissi*, *Metaphire posthuma*, *Lampito mauritii*, *Perionyx sansibaricus*, *Ocnerodrilus occidentalis*, *Dichogaster bolau*, *Octochaetona paliensis* and *Ramiella bishambari*, belonging to the families Glassoscolicidae, Megascolecidae, Ocnerodrilidae and Octochaetidae. The species *Perionyx sansibaricus*, *Octochaetona paliensis* and *Pontoscolex corethrusus* are reported for the first time from Rajasthan.

Sathianarayanan and Khan (2006) have studied the diversity of earthworm's species of Pondicherry region. Ten species, viz., *Drawida willsi*, *Drawida limella*, *Drawida Scandens*, *Pantodrilus bermudensis*, *Pontoscolex corethrusus*, *Lampito mauritii*, *Perionyx excavatus*, *Eudrilus eugeniae*, *Octochaetona serrata* and *Octochaetona barnesi* belonging to seven genera and six families are noted in this study.

Verma et al. (2010) surveyed Gangetic plains of Uttar Pradesh during August–October 2008 and reported 11 taxa of earthworms namely *Eutyphoeus incommodus*, *Eutyphoeus orientalis*, *Eutyphoeus parpingianus*, *Eutyphoeus waltoni*, *Lampito mauritii*, *Metaphire anomala*, *Metaphire biramanica*, *Metaphire posthuma*, *Pellogaster bengalensis*, *Perionyx sansibaricus*, and *Polypheretima elongata* belonging to 6 genera and 2 families. This constitutes 2.6 percent of total Indian earthworm fauna. Of these 4 taxa are exotic with extra Indian origin. Collection and environmental information on each occurrence of a species are given. Joshi and Swati (2009) reported that subtropical forest ecosystem in the foot hills of the Shivalik of Himalayas in India contain six species of earthworms representing two families, Octochaetidae and Megascolecidae.

Ishtiyag and Anisa (2011) have reported total eight species of earthworms belonging to three different families viz., Moniligastridae, Megascolecidae and Lumbricidae in Kashmir Valley. Out of the eight species three species *Aporrectea caliginosa*, *Octolasion* and *Eisenia fetida* are reported for the first time from Kashmir Valley.

However, there is a paucity of information regarding the earthworms present in and around Gulbarga city located in Karnataka. Therefore, in the present study the survey of earthworm is carried out in and around the city of Gulbarga. Further the physicochemical properties of the soil, morphology, taxonomy and anatomy of the earthworms found in this region is undertaken.

### MATERIALS AND METHODS:

#### Site Selection

For the survey of earthworms in and around the city of Gulbarga, the following sites were chosen in water logging and damp places. They are Public Garden, moat around the fort in the city, open drains, flower gardens around the city, Green houses and M.S.K. Mill area. The selected places have different types of soil formation and moisture and organic matter. The study sites are located geographically at an altitude 452 m above MSL at longitude 76° 04'N to 77° 42' N and latitude 17° 46' East at Gulbarga region of Northeast region Karnataka state, India (Fig.1).

#### Earthworm Sampling:

Earthworms for the present taxonomic study were collected by digging and hand sorting method. Samples were taken from Public Garden of Gulbarga, moat around the fort in the city, open drains, flower gardens around the city, Green houses and M.S.K. Mill area.

The methodology adopted for earthworm collection was based on Julka (1988). Collected worms were washed in fresh water and stored in plastic bottles. Ethyl alcohol was gradually added to the plastic bottles where the specimens were kept and then transferred to the dish containing solution 5% formalin for fixation. They were left for a period of 6 to 8 hours, followed by their preservation in 70% ethyl alcohol. The entire specimens were serially numbered and necessary field data such as habitat, locality, soil texture, colour and occurrence were recorded.



Fig. 1: Map showing the location of study area of Gulbarga region Karnataka, India

The collected earthworms were sorted and separated into eight groups based on their morphological characters such as colour, shape, size, prostomium, clitellum etc. Earthworms were identified with the help of monographs and other available literature on the subject (Stephenson, 1923; Gates, 1972; Julka, 1988) at Department of Zoology, Gulbarga University, and Gulbarga and later confirmed by experts at Zoological Survey of India, Kolkata. Voucher specimens of all specimens examined and reported in the present work are deposited in the museum of Department of Zoology, Gulbarga University Gulbarga. Of the eight morphologically different types of earthworms, the identification of only three types could be confirmed by the Zoological Survey of India, Kolkata. The remaining five types could not be identified because of paucity of literature.

Table-1: Physicochemical factors of soil of earthworm habitats

Parameters	Habitat of earthworms				
	Garden I	Fort moat/open drains	Flower garden (pots)	Green house	M.S.K. Mill
pH	6.80±0.21	7.00±0.23	7.0±0.24	6.8±0.43	7.6±0.32
Salt	0.29±0.04	0.50±0.08	0.52±0.08	0.29±0.11	0.85±0.12
OC%	0.33±0.04	0.32±0.01	0.48±0.23	0.33±0.06	0.60±0.03
P kg/acre phosphorus	12±1.02	12.44±1.15	15.38±1.42	12.16±1.33	12.98±0.66
K kg/acre potash	200±14.31	190.60±32.82	207.78±18.9	220.0±42.18	198.9±20.60
Moisture content of the soil	73.3%	93.4%	86%	83.3%	68.3%

M ± SE = mean ± standard error.

Analyses have been done by taking 8 samples from each locality

**Analysis of the Soil Sample:**

Soil samples collected from various study sites were analyzed for soil texture by international Pipette method (Piper, 1966), moisture by oven drying method (Santhanam et al., 1989), pH by Digital meter (Mishra, 1968). Percentage of organic carbon (OC%), Phosphorus (P) kg/acre, Potash (K) kg/acre were measured in the Agriculture Soil Testing Centre, Gulbarga.

**Statistical Calculation:**

All the analyses have been done by taking 8 samples from each locality. The statistical calculations such as arithmetic mean, standard deviation and standard error were made as described by Snedecor (1946).

**RESULTS:**

**Soil analysis:**

Results of the soil analysis show, the pH ranges from 6.80±0.21 to 7.6±0.32. Salts content varies from 0.29±0.04 to 0.85±0.12. OC ranged from 0.32±0.01 to 0.60±0.03. P kg/acre ranges between 12±1.02 to 15.38±1.42. K kg/acre varies from 190.60±32.82 to 220.0±42.18. Moisture content ranges from 68.3% to 93.4%. The details are shown in the Table 2.1.

**Identification earthworms:**

The earthworms found in all the sites belong to a single family Megascolecidae, its two subfamilies namely Octochaetinae and Megascolecinae three genera, namely *Pheretima*, *Perionyx* and *Dichogaster*. They are identified as *Polypheretima elongata*, *Perionyx sansibaricus* and *Dichogaster bolau*.

**Polypheretima elongata: (Table .2, Plate.1 and Fig.2)**

It is a dominant species found near the moist and damp places near the sewage water or the standing water connected to the sewage water. The water is usually rich in organic matter. The sites in which this species is found are Langoti Peer near Shahabazar, Public Garden, and MSK Mill open ground and occasionally along the open drains of Gulbarga. It is an endogeic species present deep in the soil. They were collected by digging. This worm belongs to family Megascolecidae and sub family Megascolecinae genera *Polypheretima* and species *elongata*. The size ranges from 9.5 to 230 mm in length. Body is without pigmentation. The feeding habit is geophagous. It is found in posture soil. Vertical distribution of the worm is about 30 to 48 cms. The soil organic matter ranges from 0.33 ± 0.04 to 0.60 ± 0.03. Soil pH ranges from 6.80 ± 0.21 to 7.6 ± 0.32. Soil temperature ranges from 20 to 28°C. Percentage of soil moisture ranges from 68.3 to 73.3. Habitat is subsoil endogeic (Table 2).

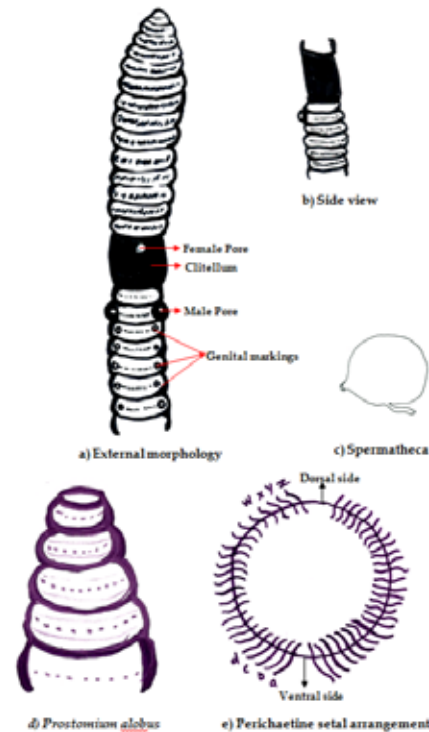
**Table - 2: Ecological factors, habitat and size of three earthworm species of Gulbarga**

Species	Family	Size (mm)	Colour	Feeding habit	Site	Vertical distribution (cms)	Soil organic matter (%)	Soil pH	Soil temperature (°C)	Soil moisture (%)	Ecological category
<i>Polypheretima elongata</i>	Megascolecidae	L 95 - 230 D 4 to 5	Unpigmented	Geophagous	Pasture soil	30-45	0.33±0.04 to 0.60±0.03	6.80±0.21 to 7.6±0.32	20-28	68.3 to 73.3	Subsoil endogeic species
<i>Perionyx sansibaricus</i>	Megascolecidae	L.32 - 66 D 2.3 to 3.5	Deep black brown	Phytophagous	Leaf litter sewage	0-15	0.32±0.01 to 0.42±0.03	7.00±0.23 to 7.10±0.32	20-28	83.6	Epigeic (leaf litter species)
<i>Dichogaster bolau</i>	Octochaetidae	L 22 - 45 D 1.3 to 1.5	Moderately pigmented	Phytogeo-phagous	Soil cow dung juncture	0.10	0.48±0.23 to 0.33±0.06	7.0±0.24 to 6.8±0.43	20-28	83.3 to 86	Epigeic species

L = Length  
D = Diameter  
M ± SE = mean ± standard error.



**Plate – 1: Polypheretima elongata**



**Fig. 2 : Polypheretima elongata**

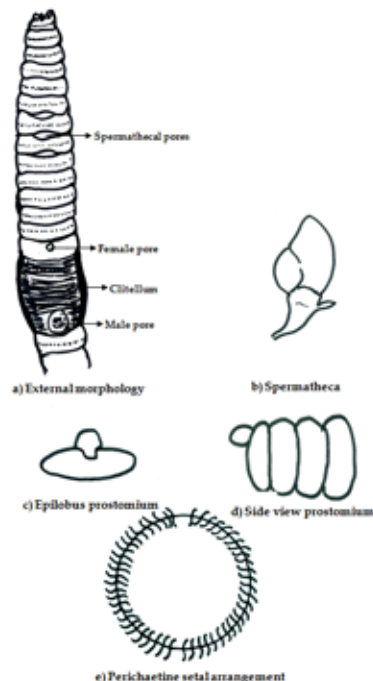
**b) Perionyx sansibaricus: (Table. 2, Plate. 2 and Fig.3)**

This is second largest species found in and around Gulbarga. It is found open drains wherein wastewater flows. Also present in the soil or in places where organic matter is settled. They are found in large number along the sides of the drains below the stones or the below the waste cloth or plastic bags hanging on the other sides of drains. They are very much fond of places where animal and human waste is present.

They can be collected by hand sorting. *Perionyx sansibaricus* belongs to family Megascolecidae. The size is about 32 to 66 mm in length and 2.3 to 3.5 mm in diameter and body colour is deep brown. Feeding habit is Phytophagous. Vertical distribution in soil is 0.15 cms, while soil organic matter ranges from 0.32 ± 0.01 to 0.42 ± 0.03%, pH of the soil is ranges from 7.00 ± 0.23 to 7.10 ± 0.32, temperature of the soil ranges from 20 to 28°C and percentage of soil moisture ranges from 83.62 to 93.4%. This is epigeic in habitat i.e., leaf litter species (Table 2).



**Plate 2 : Perionyx sansibaricus Mich**



**Fig.3 : Perionyx sansibaricus**

c) *Dichogaster bolau* (Table 2, Plate.3 and Fig. 4)

This species is also found in the flower gardens and the soil present in the flower pots. This also found near the bore wells where the water is not connected to the sewage. Because of their small size many a times they are mistaken as larvae of larger species of earth worms. These worms are collected by digging. *Dichogaster bolau* belong to family Octochaetidae. Size ranges from 25 to 40 mm in length and 1.3 to 1.5 mm in diameter. They are moderately pigmented. They are Phytogeophagous, feeding habit found near soil cow dung juncture. Vertical distribution in soil is about 0.10 cms. Organic matter of soil ranges from  $0.33 \pm 0.06$  to  $0.48 \pm 0.23$ , pH ranges from  $6.8 \pm 0.43$  to  $7.0 \pm 0.24$ , soil temperature ranges from 20 to 28°C and soil moisture ranges from 83.3 to 86%. It is an epigeic species (Table- 2).



Plate 3: *Dichogaster bolau* (Mich.)

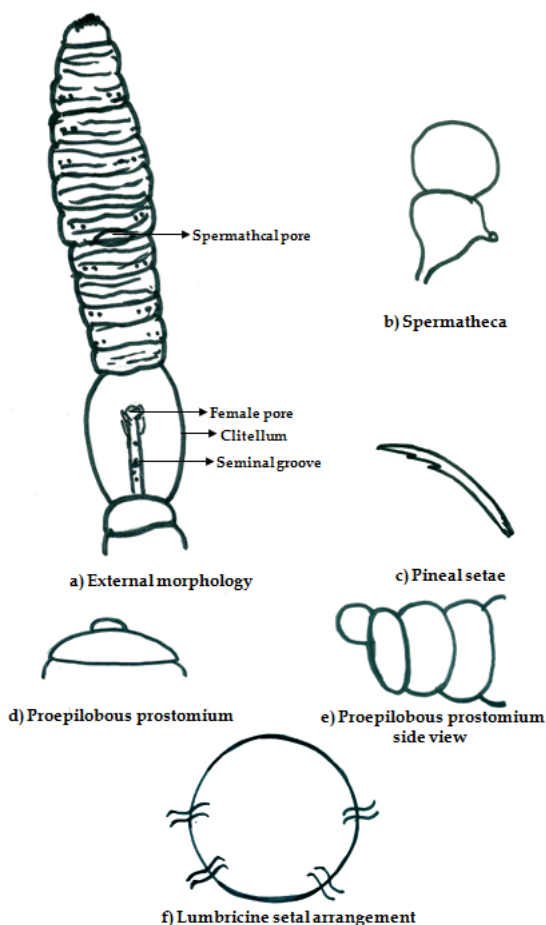


Fig. 4 : *Dichogaster bolau*

**DISCUSSION:**

The texture of soil has great influence on the distribution and population structure of earthworms.

In the present investigation the soil of all the collection sites ranges from clay loam to silty clay loam, from sewage drains to public gardens. In this study, the earthworms collected from different localities of Gulbarga city were identified in our laboratory with the help of their morphological and anatomical characters. The confirmation shows three species belonging to two families Megascolecidae and Octochaetidae. They are *Polypheretima elongata*, *Perionyx sansibaricus* and *Dichogaster bolau*.

*Polypheretima elongata* is found in the public garden and along the edge of standing water near M.S.K. Mill area. Similarly, Borges and Moreno (1990) collected this species from different soils and elevations ranging from 23 to 610 m. Some authors considered this species to be epigeic (Alfaro and Bordges, 1996) but others state that it lives in deep galleries in the soil (Rodriguez and Reines, 1989). The species has been found in area receiving cattle dung (Gates, 1972; Rodriguez and Reines, 1986). This species has been reported recently from various places like, Samoan archipelago (Samuel James, 2004), Gangetic plains of Uttar Pradesh, India, (Verma et al., 2010) and Guadeloupe island French West Indies (Csuzdi and Pavlicek, 2009).

In the present study *Polypheretima elongata*, an epigeic species is found in pasture soil. It is deep sub-soil endogeic species and lives in the soil where fairly organic matter is available with more or less neutral pH. *Perionyx sansibaricus* epigeic was found all along the flow of open drainage water and it is a common species in Gulbarga. It is leaf litter species.

Among the nine species of earthworms collected from different habitats of Jodhpur district of Rajasthan, the presence of *Perionyx sansibaricus* and *Dichogaster bolau* have also been reported by Tripathi and Bhardwaj (2005). *Perionyx sansibaricus* is reported from Gangetic plains of Uttar Pradesh, India (Verma et al., 2010).

*Dichogaster bolau* is found in damp soil with rich vegetation. In Gulbarga region this species is seen in flower gardens, green houses and flower pots where ornamental plants are grown. This species is reported from Columbia (Al-Yousuf et al., 1986), and Samoan Archipelago (Jimenez et al., 1998; Dalmini, et al., 2001). Further Samuel James (2004) and several investigators have reported that *Dichogaster salines*, closely related to *Dichogaster bolau*, dwells citrus plants and burnt canes as endogeic and polyhumic worm. However, *Dichogaster bolau* reported in the present study is epigeic in nature.

Different species of *Dichogaster* are found all over in the tropics and subtropics. This is the only known epigeic earthworm found in Europe and seen in green houses and sewage systems (Rota and Schmidt, 2006; Csuzdi et al., 2008). *Dichogaster bolau* is also found in Australia, Ryu-Kyu islands, Taiwan, China, South East Asia, USA and Canada (Blackmore et al., 2006).

Our findings are more or less similar with the findings of other investigators in different localities. It is found that *Polypheretima elongata* is sub soil endogeic and geophagous, *Perionyx sansibaricus* is epigeic and phytophagous and *Dichogaster bolau* is epigeic and Phytogeophagous in their habitat.

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