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Earthworm Resources of North Semi-Dry Region of Indo-Gangetic Plains, India

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KEYWORDS

Eutyphoeus sp., *Lampito mauritii*, Metaphire *Posthuma*, *Polypheretima elongate*, Indo-Gangetic Plains

A B S T R A C T

The studies represent a contribution to our present knowledge on the contemporary biodiversity of earthworm resources of north semi-dry region of Indo-Gangetic Plains of India. Based on survey of study area 7 taxa of earthworms belonging to five genera and two families namely, *Eutyphoeus orientalis* Beddard; *Eutyphoeus waltoni* Michaelsen; *Eutyphoeus incommodus* Beddard; Metaphire *posthuma* Vaillant ; *Metaphire anomala* Michaelsen; *Lampito mauritii* Kinberg and *Polypheretima elongata* Perrier were collected from the study area. Field observations have confirmed that *Metaphire posthuma* Vaillant contribute material for the preparation of earthworm inventory for the region. The investigation updates first-hand information on earthworm bioresources for the study area.

Introduction

The Indian earthworm fauna is predominantly represented by native species which constitute about 89% of total earthworm diversity in the country. The family Octochaetidae with 26 genera is more commonly found in Indian ecosystem Julka (1988). Earthworm resources of India are known particularly from Himalayan, Indo-Gangetic and Deccan peninsula. The Deccan peninsula is rich in earthworm fauna and harbours many epigeic and anecic species such as *Dichogaster bolaui, Drawida willsi, Perionyx excavatus, P. sansibaricus, Lampito mauritii, Pellogaster bengalensis* and other species, which have great potentiality for use in vermitechnology (Dash and Senapati 1985, Dash 1999). The North-east and Himalayan regions are also rich in many endemic and few exotic species of earthworms (Bhadauria and Rama Krishnan 1989, 1991; Bhadauria *et al*., 2000). However, through human transport, many exotic species have been imported from many other regions of the world, especially from Europe, Africa and America and some groups have been distributed worldwide (Jamieson 1978; Reynolds and Cook 1976). Indo-Gangetic plains is also

rich in earthworm fauna, especially the endemic species of *Eutyphoeus* in alluvial soils. The studies represent a contribution to our present knowledge on the contemporary biodiversity of earthworm resources of north semi-dry region (district: Aligarh, Agra and Mathura) of Indo-Gangetic plains and contribute material for the preparation of earthworm inventory for the region.

Methodology

The study area (north semi dry region Indo-Gangetic plains) situated between 27° 10' - 27° 30' N latitude and 78° 05'- 77° 41' E longitude, 178 meters altitude, highly fertile with alluvial soil affected by salts, having flat topography broken by numerous ponds, lakes, rivers like Ganga and Yamuna. The vegetation is tropical dry and dry deciduous.

Earthworm's collection was processed following Julka (1988). These were narcotized using ethyl alcohol. Live worms were placed in flat-bottomed container with little fresh water. Ethyl alcohol was gradually added to the water till the worms became motionless. When the worms no longer responded these were removed from the water and placed on cotton in a straight position. They were then transferred to a flat dish containing a solution of 5% formalin for fixation for 24 hours. Care was taken that the preserved worms were placed in straight position because curled and twisted specimens were difficult to handle during dissection. The specimens were preserved in suitable sized capped test tubes in 4% formalin. A label providing information on locality, altitude, latitude, date and time of collection, habitat etc. were pasted to each vial. The preservative was changed weekly, especially in case of large worms.

Sometimes for lack of adequate time in the field it was not possible to follow this procedure. In such a situation the worms were preserved directly in 4-10% formalin depending on their size.

Earthworms were studied and identified after dissection since; their generic or super-generic identification is based on internal characters. Before dissecting, external characters like shape of prostomium, location of male pore, female pore, genital marking, spermathecal pore and form and extent of clitellum were recorded. It was then pinned in a dissecting dish, containing water at the anterior and posterior ends, taking care to avoid injury to the prostomium. We used a fine scissor or sharp shaving blade to open body longitudinally slightly to the left or right side of the mid dorsal line in order to avoid damage of dorsal pores. After careful incision of septa, the flaps of the body wall were slowly pinned out with a fine forceps, preferably first at the post-prostatic region and then counting forward. Care was taken to record exact location of missing and delicate septa in the gizzard region.

The structure of prostate gland, shape and location of spermathecae were examined under stereoscopic zoom binocular microscope (40X). Earthworms were identified with the help of monographs and other available literature on the subject (Stephenson 1923; Gates 1972; Julka 1988) at the Vermiculture Research Station (VRS), D.S. College, Aligarh and later confirmed by experts at Zoological Survey of India, Kolkata. Voucher specimens of all species examined and reported in the present work are deposited in the Museum of VRS, for future reference and study.

Field Plots

The habitat preferences for earthworms' collection were taken in the following plots located in study area:

(i) *Grassland (ungrazed)*: Soil texture, slity clay loam (sand 33.0%; silt 37.5%; clay 29.5%); moisture 25-30%; temperature 25 to 30^{0}C; pH 7.5 – 8.0; organic matter 5.05%.

(ii) *Grassland (grazed)*: Soil texture, clay loam (Sand 46.0%; silt 20.0%, clay 34.0%); moisture 20.25%; temperature 22-25^{0}C; pH 6.87-7.0; organic matter 1.89%.

(iii)*River bank*: Nearby vegetation comprises of mainly grasses and weeds. Soil texture, Clay loam; Temperature 15-18^{0}C; pH 8.0-8.2; Organic matter 0.42%.

(iv)*Dung heap*: The dung heaps are large amount of decomposed vegetable material; moisture 28-30%, temperature 25-30^{0}C, pH 6.94-7.0; organic matter 4.63%.

(v) *Cultivated land* : The terraced field with seasonally grown agriculture crops viz. pulses, paddy, wheat and vegetables; manured periodically with chemical fertilizers and FYM; soil texture, sandy loam; pH 7.0-7.5; temperature20-25^{0}C; organic matter 2.35%.

Results and Discussion

In the present study a series of earthworm surveys of north semi dry region of Indo-Gangetic plains have been undertaken in 2008 during monsoon period in an attempt to contribute material for earthworm fauna of the country and update the existing information on their availability for the study area. All species collected from the field have been identified taxonomically and the details follow:

Family : Octochaetidae

Endemic Octochaetids in this region belong to the genus *Eutyphoeus* are represented by fairly large sized geophagous worms of 3 species which are inhabitants' balui domat soil. They form casts on soil surface in the form of coiled towers.

Distinguish features**:** Body cylindrical, dorsal pores present, male pore in front of Clitellum, occupied xvi-xviii segments, spermathecal pores present, terrestrial in habitat, setae lumbricine and prostate gland tubular.

Distribution: Africa, Australia, India and Burma.

1. *Eutyphoeus orientalis* Beddard

Origin : Native
Locality and Collection no.: Agra (Fort-park) G/124
Date of collection : 19.09.2008
General habitat : Ungrazed grassland

2. *Eutyphoeus waltoni* Michaelsen

Origin : Native
Locality and Collection no : Agra (Fort-park) G/127
Date of collection : 19.09.2008
General habitat : River bank

3. *Eutyphoeus incommodus* Beddard

Origin : Native
Locality and Collection no (s): Aligarh: Malviya Library D/01, Dept. Chemistry A.M.U D/05; Mathura : Sophia Public School Raya D/16, Agricultural Research Training Center D/17.
Date(s) of collection :18.08.2008 to 17.10.2008

General habitat : Ungrazed grassland, cultivated land

Family : Megascolecidae

The Megascolecidae is the largest and widely distributed family of the Oligachaeta. It comprises 30 Indian genera, of which *Pheretima* (*Metaphire*) is represented by the largest genus having 13 Indian species. Mostly these are highly peregrine and have established themselves in most of the warmer regions of the globe. The distribution range of the family extends between warm-temperate Asia and Australia. Two genera of the pheretimoid group, *Amynthas* and *Metaphire* are endemic in Burma, and Andaman and Nicobar Islands but are peregrine in other parts. *Pheretima* and *Polypheretima* are exotic in this subcontinent (Julka, 1993).

Distinguish Features : Body cylindrical, dorsal pores present, male pore in front of clitellum located in xviii segment, female pore in xiv segment, genital marking present in all species except *Lampito mauritii* and *Metaphire birmanica;* Clitellum annular type, spermathecae present in all species but absent in *Metaphire anomala*; Prostomium rudimentary in *Polypheretima elongate*; prostate gland racemose type.

4. **Metaphire *posthuma* Vaillant**

Origin : Native
Locality and Collection no(s) : Aligarh : Malviya Library Garden D/01, Jawahar National Horticulture Garden D/03, Aligarh City School Baroli Nagla Road D/04, Kamalpur Garden D/23, Primary School Grassland Kamalpur D/25, Primary School Kamalpur Grassland D/26, Alinagar Wasteland D/27, Alinagar Grassland D/29, Jawa Grassland D/38, Badali Mango Planted Land Jawa D/39, Jawa Wasteland D/40, Jawa Agriculture Land D/41, Rambagh, D/37 Jawa Grassland ; Agra: Mankameshwar Temple D/30-31, Yamuna river bank D/32, Naripur D/34, Padmanagla D/36; Mathura: D/17 Agricultural Research Training Centre, Agamal Girls College Raya D/19.

Date(s) of collection : 18.08.2008 to 18.10.2008
General habitat : Ungrazed grassland, cultivated land, river bank and irrigation canals.

***5.* *Metaphire anomala* Michaelsen**

Origin : Native
Locality and Collection no. : Aligarh (Agra road) B/43.
Date of collection : 21.08.2008
General habitat : Cultivated land

6. *Lampito mauritii* Kinberg

Origin : Native
Locality and Collection no(s): Aligarh: Tasvir Mahal D/02, Jawahar National Horticulture Garden D/03, Kamalpur agriculture land D/21, Kamalpur (mango garden) D/23, Kamalpur Wasteland D/24, Jawa Grassland D/38, Baroli (mango planted land) Jawa D/39, Baroli (waste land) Jawa D/42; Agra: Fort D/33, Naripur D/34, Padmangla D/36, Park of Dr. Bhimrao Ambedkar University D/37, City hospital garden D/08; Mathura: Cantonment area D/20, Kamalpur agriculture land D/21, Kamalpur garden D/23, Kamalpur waste Land D/24.

Date(s) of collection : 18.08.2008 to 16.10.2008.
General habitat : Ungrazed grassland, cultivated land- paddy crop, river bank, irrigation canal.

7. *Polypheretima elongata* Perrier

Origin : Exotic
Locality and Collection no: Aligarh: Aligarh City School Baroli Nagla

Road D/04.
Date of collection : 18.08.2008
General habitat : grazed grassland.

As a result of painstaking efforts 45 field samples of the existing earthworms were collected and identified from diverse habitats of the study area. The study has brought to light and confirms the existence of 7 species including 01 exotic with extra Indian origin. Field observations have confirmed that *Metaphire posthuma* Vaillant is predominant species with wide distribution within the study area. Data presented on contemporary earthworm biodiversity in the study area is based on first-hand information and material collected from the field and literature research.

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