

Earthworm Biodiversity of Morena District Madhya Pradesh: Taxonomic Description

Paper Submission: 00/00/2020, Date of Acceptance: 00/00/2020, Date of Publication: 00/00/2020



Satendra Singh Tomar

Assistant Professor,
Dept. of Zoology,
Ambah Post Graduate College,
Ambah District Morena, M.P., India



A.K. Deshpande

Designation,
Dept. of Zoology,
Ambah Post Graduate College,
Ambah District Morena, M.P., India

Abstract

Our current study deals with biodiversity and bio-distribution of earthworm population in Morena district, Madhya Pradesh. Finding suggested that Morena region is very rich in biodiversity population of earthworm. Collections were made during rainy or humid season according to Indian seasonal calendar. *Lampito mauritii* and *Eudichogaster prashadi* are the dominant species among Morena collection site. There are 23 species out of genera 12 and 4 families. Collected specimens were identified by identification keys given by Blakemore's (2006) and Julka (1988).

Keywords: Biodiversity; Earthworm; Species; Morena; Habitat etc.

Introduction

The earthworm belong to the phylum Annelid and class Oligochaeta. It is the "Intestine of earth" it's a natural bio-reactor which convert the organic waste in to organic manure by this they enhance soil fertility, porosity, health and productivity. There are some ecological types of earthworm have been recognized viz. epigeic, endogeic, anecic. In agro-ecosystem earthworms play an important role in cultivation. Their habitat of burrows and swallows helps to increase the fertility of agriculture field in many ways. Their burrow permits the aeration and moistures in the porous soil and improves the water holding capacity. The earthworms are continuously ploughing the soil and eat dead leaves. They are digested and mixed with the castings. They provide optimum conditions for plant growth and microbial productivities by reducing both alkalinity and acidity of soil. Plant growth stimulants such as auxin hormones are produced in the earthworm castings. The present study of earthworm diversity and are conducted in the different sites of Morena which include agro- ecosystem, forest ecosystem and polluted ecosystem.

Morena is a diverse district harboring a very high diversity of earthworm mainly concentrated in Morena. It located in the North western border of the state in Chambal valley. It lies between latitude 26.5° N and longitude 78.0° E.

Aim of the Study

The main objective of the study was to collect existing information on earthworm biodiversity in the study area with special reference to vermicomposting species. A field survey of earthworms was done in Morena district from July 2019 to March 2020, including 23 species belonging to 12 genera and 4 families. Scientific names, origins, common habitat of earthworms are given for each species discussed in the text. *Eudrilus eugeniae* has been identified as a potential species for vermicomposting with a preference for dung heaps. Morena district is enriched in terms of biodiversity.

Material and Methods

Earthworms for the present taxonomic study were collected by digging and hand sorting method from during July 2019 to March 2020. The total earthworm collection is 6 tehsil from 35 sampling sites in districts Morena district (table2), (Figure1). To examine the identification of earthworm, it should be washed under tap water and lie on 80% Ethyl alcohol (Blakemore et. al. 2010) containing

tray to narcotize the worms. After that worm's body stretch little to perform its normal length and position then follow two processes: Earthworms move to 4% formaldehyde (Sims and Gerard, 1985) for permanent preservation and morphological identification.

All formalin preserved specimens were deposited in Zoological Museum, Department of Zoology, Ambah Post Graduate College, Ambah District Morena (Madhya Pradesh) India.

Results and Discussion

Earthworm survey conducted in 35 different sites of Morena district revealed occurrence of 12 genera and 23 species belonging to family Eudrilidae, Megascolecidae, Moniligastridae and Octochaetidae collected from different habitats (Table1). Earthworm species *Eudrilus eugeniae*, *Lampito mauritii*, *Metaphere houlleti*, *Perionyx excavatus*, *Polypheretima elongata*, *Drawida minuta*, *Drawida pellucida*, *Drawida willsi*, *Barogaster annandalei*, *Barogaster barodensis*, *Barogaster prashadi*, *Eudichogaster mullani*, *Eudichogaster prashadi*, *Eutyphoeus nicholsoni*, *Eutyphoeus orientalis*, *Eutyphoeus turaensis*, *Lennogaster falcifer*, *Lennogaster pusillus*, *Octochaetona beatrix*, *Octochaetona paliensis*, *Octochaetona parva*, *Ramiella bishambari*, *Ramiella nainiana* were collected from the study area and out of 15 species comprises (154 species Indian Octochaetids- Julka, 1988). The density of earthworms was found to be very rich. *Lampito mauritii*, *Eudichogaster prashadi* are more abundant and *Eudrilus eugeniae*, *Metaphere houlleti*, *Perionyx excavatus*, *Polypheretima elongata*, *Drawida minuta*, *Drawida pellucida*, *Drawida willsi*, *Barogaster annandalei*, *Barogaster barodensis*, *Barogaster prashadi*, *Eudichogaster mullani*, *Eutyphoeus nicholsoni*, *Eutyphoeus orientalis*, *Eutyphoeus turaensis*, *Lennogaster falcifer*, *Lennogaster pusillus*, *Octochaetona beatrix*, *Octochaetona paliensis*, *Octochaetona parva*, *Ramiella bishambari*, *Ramiella nainiana* are less abundant in study area.

Taxonomic section

Morpho-anatomical identification

Morpho-anatomical identification was done under a microscope by referring to Blakemore's (2006) and Julka (1988) identification keys for family label and genera, species label Identification key's referring to Eudrilidae (Gates 1972), Moniligastridae (Stephenson 1923), Megascolecidae (Gates 1972), and Octochaetidae (Julka 1988). Species identification of adult earthworms is possible by dissection of the male genitalia; however, this method is labor intensive, time consuming and very difficult for no specialists, particularly when dealing with field collections consisting of several different earthworm species. Furthermore, identification is limited to adult worms, as most life stages are unidentifiable. Many morphological and anatomical characteristics of

earthworms are variable, and the degree of variability can differ and features can overlap between taxa. The Earthworm species collected and identified from the study area are arranged family-wise in alphabetical order. Scientific name, voucher specimen number, date of collection and general habitat.

Table section

Table1: Details of the Classification, Origin, Locality, Specimen No., Date of collection and General Habitats.

Table2: Earthworm collection site of Morena District.

Table3: Recorded earthworm species in Morena District.

Figure section

Figure 1: Study site of Earthworm diversity in the Morena region of Madhya Pradesh (India).

Figure 2: Genital Region:

1. *Eudrilus eugeniae*,
2. *Lampito mauritii*,
3. *Metaphere houlleti*,
4. *Perionyx excavatus*,
5. *Polypheretima elongata*,
6. *Drawida minuta*,
7. *Drawida pellucida*,
8. *Drawida willsi*,
9. *Barogaster annandalei*,
10. *Barogaster barodensis*,
11. *Barogaster prashadi*,
12. *Eudichogaster mullani*,
13. *Eudichogaster prashadi*,
14. *Eutyphoeus nicholsoni*,
15. *Eutyphoeus orientalis*,
16. *Eutyphoeus turaensis*,
17. *Lennogaster falcifer*,
18. *Lennogaster pusillus*,
19. *Octochaetona beatrix*,
20. *Octochaetona paliensis*,
21. *Octochaetona parva*,
22. *Ramiella bishambari*,
23. *Ramiella nainiana*

Conclusion

1. During the survey, earthworms of *Lampito mauritii* and *Eudichogaster prashadi* species were found in most parts of Morena district.
2. More earthworm species are found in places with moisture and excess organic matter.
3. In our study, 23 species were surveyed, of which 3 were exotic and 20 were of native origin.

Acknowledgements

I am most grateful to thanks Dr. Rishikesh Sharma and Dr. D. K. Sharma for his helpful and kind assistance in confirming earthworms identified. I am sincerely grateful to Dr. Shivraj Singh Tomar for his kindly advising. Thanks to friends and colleagues for support to worm collection, preservation and identification.

References

1. Bhadauria T. & K. P. Saxena. 2010. Role of earthworms in soil fertility maintenance through the production of biogenic structures. *Applied and Environmental Soil Science* 2010: 7pages, doi:10.1155/2010/816073.

2. Bisht R., Pandey H., Bharti D. & Kaushal B. R. 2003. Population dynamics of earthworms (Oligochaeta) in cultivated soil of central Himalayan tarai region. *Tropical Ecology* 44: 221-226.
3. Beddard F. E., 1883. Notes on some earthworm from India. *Ann.Mag.Nat.Hist.* 12:231- 224(Ser.5)
4. Blakemore R. J., 2003. Japanese earthworms (Annelida: Oligochaeta): a review and checklist of species. *Org.Divers.Evol.* 3 (3):241-244.
5. Blakemore R. J., Chih-Han Chang, Shu-Chun Chuang, T. Masamichi Ito, Sam James & Jiun-Hong Chen. 2006. Biodiversity of earthworms in Taiwan: a species checklist with the confirmation and new records of the exotic lumbricids *Eisenia fetida* and *Eiseniella tetraedra*. *Taiwania* 51: 226-236.
6. Blakemore R. J., Lee Seunghan, Lee Wonchoel and Seo Hong-yul, 2013. Two new Korean earthworms (Annelida: Oligochaeta, Megadrilacea, Megascolecidae). *Zookeys.* (307): 35-44.
7. Blakemore R. J., 2016. Darwin's earthworms (Annelid, Oligochaeta, Megadrilacea) with review of cosmopolitan *Metaphire peguana* species group from Philippines. *OpusculaZoologica.* 47(1): 9-30.
8. Chang C. H. & J. H. Chen. 2005. Taxonomic status and intraspecific phylogeography of two sibling species of *Metaphire* (Oligochaeta: Megascolecidae) in Taiwan. *Pedobiologia* 49: 591-600.
9. Deepthi M. P. and Kathireswari P., 2016. Earthworm diversity and analysis of soil inhabited by earthworm in the Vatakara area Kozhikode (Kerala) India. *Int. J. Curr. Microbiol. App. Sci.* 5 (3):917-925.
10. Doube B. M., Stephens P. M., Davoren C. W., and Ryder M. H., 1994. Interactions between earthworms, beneficial microorganisms and root Pathogens. *Appl. Soil Ecol.* 1:3-10.
11. Easton, E. G. (1982). The identity of *Perichaeta lawsoni* Bourne, 1986. (*Syn. Megascolex curgensis* Michaelsen, 1921) (*Megascolecidae: Oligochaeta*). *Megadrilologica* 4(1): 1-3.
12. Julka, J.M. 1975. Notes on the earthworms from Darjeeling district, with descriptions of the two new species. *Mitt. Zoological Museum Berlin*, 51: 19-27.
13. Julka J. M. and Senapati B. K., 1987. Earthworms (Oligochaeta: Annelida) of Orissa, India. *Records of the Zoological Survey of India. Miscellaneous Publication Occasional Paper No.* 92:1-49.
14. Julka J. M., 1988. The fauna of India and The adjacent countries. *Megascolecidae: Octochaetidae (Earthworms) Haplotaxida: Lumbricina: Megascolecidae: Octochaetidae xiv.* *Zoological Survey of India, Calcutta.* pp.400.
15. Julka JM, Paliwal R (1994). On a new species of *Plutellus* Perrier (Acanthodrilidae: Oligochaeta from Northwest Himalayas, India, and Indian. *Res. Bull. Punjab Univ.* 44: 217-220.
16. Julka J. M., Blanchart E. and Chapuis-Lardy L., 2004. New genera and new species of earthworms (Oligochaeta: Octochaetidae) from western ghat, South India. *Zootaxa* 486:1-27.
17. Kushwaha T., Vishwakarma A., Paliwal Rahul, Burla Sashidhar, Yadav Shweta, 2015. A simple protocol to extract DNA from earthworm tissue for molecular studies. *Research & Reviews Journal of Zoological Science.* 4 (1): 33-37.
18. Lee K. E., 1985. Earthworms, their ecology and relationships with soils and land use. *Academic Press, Sydney, Australia.*
19. Michaelson W., 1910. Die Oligochaeten fauna der Vorderindischceylonischen Region. *Adh.Geb. Nature. Hamburg.* 19:1-103.
20. Paliwal R. and Julka J. M., 2005. Checklist of Earthworms of western Himalaya, India. *Zoos Print Journal* 20(9): 1972-1976.
21. Palumbi S. R., Martin A., Romano S., McMillan W. O., Stice L., Grabowski G., 1991. The simple fool's guide to PCR. *University of Hawaii Press, Honolulu.*

Table1: Details of the Classification, Origin, Locality, Specimen No., Date of collection and General Habitats

Order	Family	Genera	Species	Origin	Locality/Specimens no./Date	General habitat
Haplotaxidae	Eudrilidae	<i>Eudrilus</i>	<i>E. eugeniae</i> Kinberg	Native	Kailaras/EWS06F7/06.01.2020	Debris place, Vermicompost, Leaf litter
	Megascolecidae	<i>Lampito</i>	<i>L. mauritii</i> Kinberg	Native	Ambah/EWS01F1/12.07.2019 Morena/EWS02F3/08.08.2019 Porsa/EWS03F1/06.09.2019 Joura/EWS04F4/10.10.2019 Kailaras/EWS06F2/02.01.2020 Sabalgarh/EWS05F1/03.02.2020	High organic matter
		<i>Metaphere</i>	<i>M. houletii</i> Michaelson	Native	Porsa/EWS03F8/06.09.2019 Joura/EWS04F5/10.10.2019	Leaf litter
		<i>Perionyx</i>	<i>P. excavates</i>	Native	Ambah/EWS01F7/18.07.2019	Debris place

			Perrier		Kailaras/EWS06F6/02.01.2020	
		<i>Polypheretima</i>	<i>P. elongate</i> Perrier	Native	Ambah/EWS01F6/15.07.2019 Porsa/EWS03F5/12.09.2019	Rotting leaves, Soil in wet ravines
	Moniligastridae	<i>Drawida</i>	<i>D. minuta</i> Bourne	Exotic	Sabalgarh/EWS05F2/15.02.2020	Sandy soil
		<i>Drawida</i>	<i>D. pellucid</i> Bourne	Exotic	Porsa/EWS03F6/12.09.2019	Sandy moisture soil
		<i>Drawida</i>	<i>D. willsi</i> Michaelson	Exotic	Morena/EWS02F6/16.08.2019	Yellowish Sandy moisture soil
		<i>Barogaster</i>	<i>B. annandalei</i> Stephenson	Native	Joura/EWS04F2/28.10.2019 Kailaras/EWS06F4/12.01.2020	Soil rich in moisture
		<i>Barogaster</i>	<i>B. barodensis</i> Stephenson	Native	Kailaras/EWS06F5/25.01.2020	Kitchen waste, compost pits, Rotten wood
		<i>Barogaster</i>	<i>B. prashadi</i> Stephenson	Native	Morena/EWS02F7/16.08.2019 Porsa/EWS03F7/12.09.2019 Sabalgarh/EWS05F6/01.03.2020	Soil rich in moisture
		<i>Eudichogaster</i>	<i>E. mullani</i> Stephenson	Native	Sabalgarh/EWS05F7/06.03.2020	Sandy, loamy and clay soil
		<i>Eudichogaster</i>	<i>E. prashadi</i> Stephenson	Native	Ambah/EWS01F2/14.07.2019 Morena/EWS02F1/16.08.2019 Porsa/EWS03F2/12.09.2019 Joura/EWS04F3/22.10.2019 Sabalgarh/EWS05F3/18.02.2020 Kailaras/EWS06F1/12.01.2020	Soil rich in moisture, organic matter
	Octochaetidae	<i>Eutyphoeus</i>	<i>E. nicholsoni</i> Beddard	Native	Porsa/EWS03F3/20.09.2019 Joura/EWS04F6/22.10.2019	Alluvial soil in the paddy fields
		<i>Eutyphoeus</i>	<i>E. orientalis</i> Beddard	Native	Sabalgarh/EWS05F5/18.02.2020	Kitchen waste, compost pits, rotten wood
		<i>Eutyphoeus</i>	<i>E. turaensis</i> Stephenson	Native	Morena/EWS02F2/16.08.2019 Sabalgarh/EWS05F4/15.02.2020	Dark loamy soil, compost pits rotten woods
		<i>Lenogaster</i>	<i>L. falcifer</i> Stephenson	Native	Ambah/EWS01F5/14.07.2019	Crops fields, compost pits and sewage
		<i>Lenogaster</i>	<i>L. pusillus</i> Stephenson	Native	Ambah/EWS01F3/14.07.2019	Organic matter, leaf litter and humus

		<i>Octochaetona</i>	<i>O. beatrix</i> Beddard	Native	Joura/EWS04F7/22.10.2019	Sandy, loamy and clay soil
		<i>Octochaetona</i>	<i>O. paliensis</i> Stephenson	Native	Kailaras/EWS06F8/25.01.2020	Sandy and loamy soil
		<i>Octochaetona</i>	<i>O. parva</i> Gates	Native	Morena/EWS02F5/16.08.2019 Joura/EWS04F1/18.10.2019	Sandy and loamy soil
		<i>Ramiella</i>	<i>R. bishambari</i> Stephenson	Native	Morena/EWS02F4/16.08.2019	Moist neutral soil
		<i>Ramiella</i>	<i>R. nainiana</i> Gates	Native	Ambah/EWS01F4/14.07.2019 Morena/EWS02F8/12.08.2019 Porsa/EWS03F4/20.09.2019 Kailaras/EWS06F3/18.01.2020	Mineral soil, municipal dumps

Table2: Earthworm collection site of Morena District.

No.	Sampling Tehsil Name
1.	Ambah
2.	Morena
3.	Porsa
4.	Joura
5.	Sabargarh
6.	Kailaras

Table3: Recorded earthworm species in Morena District.

Eudrilidae	Megascolecidae	Moniligastridae	Octochaetidae
1. <i>Eudrilus eugeniae</i>	2. <i>Lampito mauritii</i> 3. <i>Metaphere houlleti</i> 4. <i>Perionyx excavatus</i> 5. <i>Polypheretima elongata</i>	6. <i>Drawida minuta</i> 7. <i>Drawida pellucida</i> 8. <i>Drawida willsi</i>	09. <i>Barogaster annandalei</i> 10. <i>Barogaster barodensis</i> 11. <i>Barogaster prashadi</i> 12. <i>Eudichogaster mullani</i> 13. <i>Eudichogaster prashadi</i> 14. <i>Eutyphoeus nicholsoni</i> 15. <i>Eutyphoeus orientalis</i> 16. <i>Eutyphoeus turaensis</i> 17. <i>Lenogaster falcifer</i> 18. <i>Lenogaster pusillus</i> 19. <i>Octochaetona beatrix</i> 20. <i>Octochaetona paliensis</i> 21. <i>Octochaetona parva</i> 22. <i>Ramiella bishambari</i> 23. <i>Ramiella nainiana</i>

Figure 1: Study site of Earthworm diversity in the Morena region of Madhya Pradesh (India).

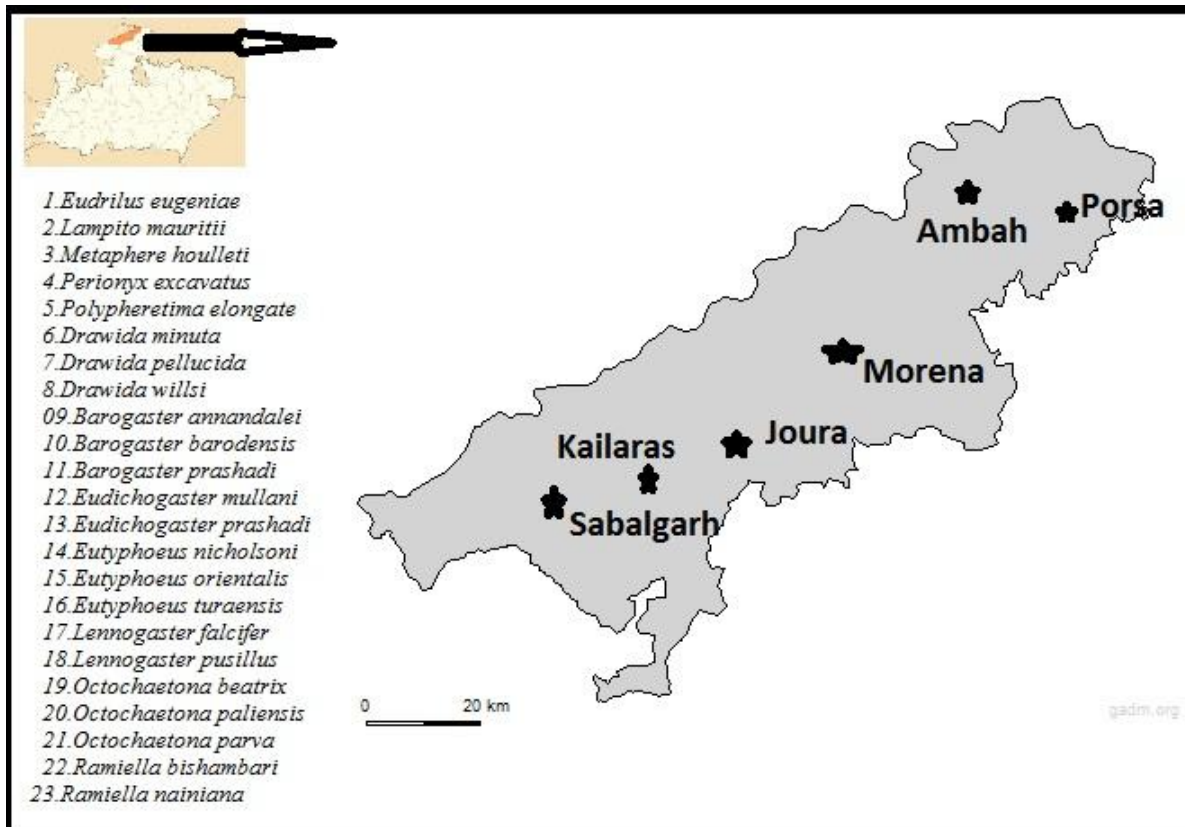


Figure 2: Genital Region

