A Comprehensive Review of Earthworm Diversity in India

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ABSTRACT

Earthworms are vital soil invertebrates that function as ecosystem engineers by regulating soil structure, nutrient cycling, and organic matter decomposition. Their ecological activities significantly influence soil fertility and agricultural sustainability, particularly in tropical and temperate regions. Although India supports substantial earthworm diversity, systematic and region-specific assessments remain uneven. Available studies indicate strong spatial variation in earthworm diversity across Indian states, influenced by climate, soil characteristics, and land-use patterns. Cosmopolitan species such as *Metaphire posthuma* are widely distributed, while regional and endemic taxa remain poorly documented. In India, current research identifies a diverse fauna comprising approximately 505 species and subspecies across 10 families and 67 genera. Notably, earthworm diversity in Maharashtra has received limited scientific attention despite its diverse agro-ecological settings. This review synthesizes existing literature on earthworm diversity in India, highlights their ecological significance, and identifies major research gaps. The study emphasizes the need for comprehensive biodiversity assessments and conservation-oriented soil management strategies, particularly in underexplored regions. This literature review indicates a significant disparity in earthworm diversity across different Indian regions. The Western Ghat biodiversity hotspot exhibits the highest species richness with 271 recorded species, followed by Kerala with 28 species. In contrast, the lowest diversity is observed in Gujarat, where only 4 species have been identified. These findings highlight that the Western Ghat remain a critical zone for earthworm abundance and taxonomic variety compared to other geographical regions.

Keywords: *Earthworms; biodiversity; soil fauna; ecosystem engineers; India*

1. Introduction

Earthworms are among the most ecologically significant soil macroinvertebrates and are widely recognized as ecosystem engineers due to their capacity to modify soil structure and regulate key ecological processes. Through burrowing, feeding, and casting activities, earthworms influence soil aeration, water infiltration, organic matter decomposition, and microbial activity, thereby enhancing soil fertility and supporting plant productivity. Historically referred to as the "intestines of the soil" by Aristotle. Originally classified by Bouche (1977) into three categories i.e., epigenic, endogenic, and anenic groups, with later refinements recognizing additional ecological subgroups [1]. These

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functional categories differ in habitat preference and ecological impact, collectively contributing to nutrient cycling and soil ecosystem stability. They represent nearly 80% of the total soil invertebrate biomass and play a crucial role in nutrient cycling [2]. Earthworms occur globally across most terrestrial ecosystems, and their distribution is strongly influenced by climatic conditions, soil properties, vegetation type, and land-use practices [3].Globally, more than 7,000 earthworm species have been described, constituting a major proportion of soil invertebrate biomass [4]. India represents one of the important centers of earthworm diversity, accounting for approximately 11% of the world's known species [5]. Indian earthworm fauna comprises several hundred species belonging to multiple genera and families, with a high proportion of native taxa. However, species richness and community composition vary considerably across regions due to environmental heterogeneity [6].

Although several studies have documented earthworm diversity in northeastern India, the Himalayan region, and selected parts of southern India, large geographical areas remain inadequately studied. In particular, Maharashtra has received limited attention despite its wide range of agro-ecological zones and land-use systems. The absence of comprehensive baseline data restricts understanding of species distribution patterns and ecological roles. This review aims to synthesize existing literature on earthworm diversity and distribution in India, emphasizing their ecological significance and functional roles in soil ecosystems. This review study is crucial for data consolidation, identification of research gaps, Assessment of native vs. Exotic species and ecological monitoring.

2. Discussion

"The species richness and taxonomic classification of earthworms recorded in Table 1."

Table 1.

Sr. No.	Name of State/Country	Name of species	No. of Species
1	Pakistan	*1)Pheretima posthuma* *2)Pheretima burliaensis* *3)Pheretima bournei*	3
2	Afghanistan	*1)Aporrectodea caliginosa* *2)Eisenia tetraedra* *3)Dravida annandalei* *4)Amynthas cortices* *5)Metaphire bahli*	5
3	Sri Lanka	*1)Megascolex spectabilis* *2)Pheretima houletti* *3)Megascolex mauritti* *4) Notoscolex sp.*	4
4	South Africa	*1)Amynthas cortices* *2)Amynthas rodericensis* *3)Dichogastor species* *4)Octolasion lacteum* *5)Amynthas aeruginosus kinberg* *6)Amynthas gracilis* *7)Amynthas minimus.* *1) Dendrobaena rubida* *2) Lumbricus castaneus* *3) Lumbricus rubellus* *4)Aporrectodea rosea*	7

		5)Lumbricus terrestris.	
5	Norway	*1) Eisenia fetida* *2)Amynthas caliginosa* *3)Amynthas chlorotica* *4)Lampito rubellus.*	4
6	Bhutan	*1)Amynthas alexandri* *2)Metaphire houletti* *3)Perionyx excavates* *4)Aporrectodea calciginosa* *5)Dichogastor sp.* *6)Pentoscolex corethurus* *7)Drawida sp.*	7
7	Karnataka	*1) Drawida modesta* *2)Drawida nepalensis* *3)Pontoscolex corethurux* *4)Eudrilus eugeniae* *5)Eutyphoeus orientalis* *6)Eisenia fetida* *7)Perionyx excavates* *8)Metaphire anomala* *9)Metaphire posthuma* *10)Lampito mauritti* *11)Amynthas alexandri*	11
8	Uttar Pradesh	*1)Lampito mauritti* *2)Metaphire posthuma* *3)Perionyx excavates* *4)Eutyphoeus nicholsoni* *5)Eutyphoeus incommodus* *6)Eutyphoeus sp.*	6
9	Punjab	*1)Amynthas morrisi* *2)Lampito mauritti* *3)Metaphire houletti* *4)Metaphire posthuma* *5)Octochaetona Beatrix*	5
10	Nagaland	*1)Amynthas sp. 5* *2)Perionyx sp. 1* *3)Drawida sp. 1* *4)Eutyphoeus 2*	9
11	Jharkhand	*Family/Genera No. of sp.* *Almidae Glyphidrilus 1* *Lumbricidae Eisenia 1* *Glossoscolecidae Pontoscolex 1* *1 Octochaetidae Dichogaster 2* *7 Pellogaster 1* *Lennogaster 1* *Ocnerodrilidae Ocnerodrilus 1* *Megascolecidae Lampito 1*	15

		Pheretima 2 *Perionyx 2* *Moniligastridae Drawida 2*	
12	Himachal Pradesh	*1)Drawida nepalensis* *2)Eutyphoeus waltoni* *3)Eisenia fetida* *4)Amynthas alexandri* *5)Metaphire anomala* *6)Metaphire birmanica* *7)Metaphire houletti* *8)Metaphire posthuma*	8
13	Pondicherry	*1)Drawida willsi* *2)Drawida lamella* *3)Drawida scandens* *4)Pontoscolex corethurus* *5)Lampito mauritti* *6)Perionyx excavates* *7)Pontodrilus bermudensis* *8)Octochaetona serrata* *9)Octochaetona barnesi* *10)Eudrilus eugeniae.*	10
14	Odisha	*1) Lampito mauritii* *2) Glyphidriiius tuberosus,* *3)Drawida willsi* *4) Drawida Celebi* *5) Pheretima alexandri* *6) Pellogaster bengalensis* *7) Octochaetona barkudensis* *8) Perionyx excavates* *9) Octochaetona serrata* *10) Pontoscolex corethrurs.*	10
15	Arunachal Pradesh	*1)Amynthas 3* *2)Perionyx 14* *3)Drawida 9* *4)Eutyphoes 4* *5)Pontoscolex 1* *6)Dichogastor 4* *7)Octochaetona 1* *8) Tonoscolex 5* *9) Bimastos 2* *10)Argilophilus 6* *11)Dendroaena 1* *12)Eudrilus 1* *13)desmogaster 1*	52
16	Assam	*1)Amynthas 5* *2)Perionyx 3* *3)Drawida 2*	23

		4)Eutyphoes 3 *5)Metaphire 2* *6)Pontoscolex 2* *7)Dichogaster1* *8)Octochaetona 1* *9)Glyphidrilus 1* *10)Gordiodrilus 1* *11)Lampito 1* *12)Eisenia 1* *13)Octolasion 1*	
17	Manipur	*1)Amynthas 4* *2)Perionyx 2* *3)Drawida 2* *4)Eutyphoes 2* *5)Metaphire 3* *6)Pontoscolex 1* *7)Dichogaster 1* *8)Octochaetona 1* *9)Kanchuria 1*	17
18	Meghalaya	*1)Amynthas 8* *2)Perionyx 8* *3)Drawida 7* *4)Eutyphoes 5* *5)Metaphire 4* *6)Pontoscolex 1* *7)Dichogaster 4* *8)Octochaetona 1* *9)Glyphidrilus 1* *10)Kanchuria 8* *11)Tonoscolex 2* *12)Polypheretima 1* *13)Nelloscolex 2* *14)Megascolides 1* *15)Notoscolex 1*	54
19	Tripura	*1)Amynthas 1* *2)Perionyx2* *3)Drawida 4* *4)Eutyphoes 9* *5)Metaphire 4* *6)Pontoscolex 1* *7)Dichogastor 3* *8)Glyphidrilus 3* *9) Gordiodrilus 1* *10)Kanchuria 1* *11)Lampito 1* *12)Polypheretima 1* *13)Nellloscolex 1*	34

		14)Lennogaster 2	
20	Sikkim	*1)Amynthas 6* *2)Perionyx 5* *3)Drawida 1* *4)Metaphire 1* *5)Pontoscolex 1* *6)Dichogastor 4* *7)Octochaetona 1* *8) Gordiodrilus 1* *9)Eisenia 1* *10)Bimastos 1* *11)Octolasion1* *12)Agrilophilus 1* *13)Dendrobaena 1* *14)Aporrectodea 2* *15)Eukerria 1* *16)Eiseniella 1*	29
21	West Bengal	*1)Amynthas 1* *2)Perionyx 1* *3)Drawida 3* *4)Eutyphoes 2* *5)Metaphire 4* *6)Pontoscolex 1* *7)Dichogaster 3* *8)Octochaetona 2* *9)Glyphidrilus 1* *10)Lennogaster 2* *11)Lampito 1*	22
22	Chhattisgarh	*1)Lampito1* *2)Perionyx 2* *3)Drawida 1* *4)Octochaetona 1* *5)Metaphire 2* *6)Eisenia 1* *7)Eudrilus 1* *8)Glyphidrilus 1*	9

3. Earthworm Diversity at the Global Level

Studies conducted across different continents reveal substantial variation in earthworm species richness and community composition, largely driven by climatic conditions, soil type, and land-use practices. Tropical regions generally support higher diversity, whereas temperate regions are comparatively better documented due to long-term ecological monitoring. Research from South Asia, Africa, Europe, and Southeast Asia indicates that both native and exotic species contribute to local earthworm assemblages, with introduced species often dominating disturbed or agricultural habitats.

Thailand: In studies identified 25 species, with the megascolecidae family being the most prominent [7].

Pakistan: Research in the Bahawalpur district recorded 1,211 specimens belonging to the genus *Pheretima*, specifically *P. posthuma, P. burliarensis*, and *P. bournei* [8].

Afghanistan: Biodiversity surveys and research revealed six peregrine species, including *Aporrectodea caliginosa, Eiseniella tetraedra, and Metaphire bahli* [9].

Bhutan: Seven species from five families recorded. Most abundant are *Amynthas alexandri* and *Perionyx excavates* [10].

Sri Lanka: In 2013, study conducted by M.W.D. Wickramaratne and S. R. Krishnarajah visited different sites for earthworm collection in Kalutara district and identified four species. *Megascolex spectabilis, Pheretima houletti, Megascolex mouritti* and *Notoscolex spp* [11]. Scientists documented a diverse population spanning nine families and nineteen genera out of that14 distinct species were confirmed [12].

South Africa: Across four south African sites researchers collected 2094 specimens, 16 species from five families were identified, which included:- *Octolasion lacteum, Amynthas aeruginosus, Amynthas cortices, Amynthas grocilis* and *Amynthas minimus* [13].

Comparative studies from countries such as Pakistan, Afghanistan, Sri Lanka, South Africa, Norway, and Bhutan demonstrate that earthworm diversity is strongly associated with habitat type and degree of anthropogenic disturbance. Agricultural lands and managed ecosystems frequently support cosmopolitan species, whereas forest and undisturbed habitats harbor more specialized or endemic taxa.

4. National Status of Earthworm Diversity in India

India possesses one of the richest earthworm faunas 11.1% of the global diversity with over 500 species and subspecies reported across diverse ecosystems [6 & 14]. Historically, the initial documentation of earthworm species from India is attributed to the work of Templeton in 1844 [15]. According to Julka and Paliwal (2005), in India native species make up more than 89% of the earthworm diversity [16]. Biological survey conducted by researchers from Karnataka, investigated earthworm populations from various sites revealed E 11 distinct species categorized into six families- *Drawida modesta, Drawida nepalensis, Pontoscolex corethurus, Eudrilus eugeniae, Eutyphoeus orientalis, Eisenia fetida, Perionyx excavates, Metaphire anomala, Metaphire posthuma, Lampito mauritii, Amynthas alexandri* [17].

In a study eastern region of Uttar Pradesh, Yogendra Kumar and Keshav Singh (2013) surveyed various part of Gorakhpur to document local earthworm population. They identified six species-*Lampito mauritii, Metaphire posthuma, Perionyx excavates, Eutyphoeus nicholsoni, Eutyphoeus incommodus* and an unidentified *Eutytphoeus spp* [18].

A study from Punjab by Sharanpreet Singh and his Colleagues (2020) examined different land use patterns and identified five earthworm species- *Amynthas morrisi, Lampito mauritii, Metaphire houlleti, Metaphire posthuma* and *Octochaetona baetrix* [19]. In Nagaland, 12 species including *Drawida assamensis* and *Eutyphoeus festivus* have been documented. Similarly, Himalayan states and parts of southern India report moderate to high diversity [20].

States like Jharkhand and Odisha show a mix of native and peregrine genera such as *Glyphidrilus* and *Dichogaster* [21]. Shailaja kumara et al. (2024) conducted study on earthworm diversity across various land use systems in Himachal Pradesh and identified total eight species. *Amynthas alexandri, Metaphire anomala, Metaphire birmanica, Metaphire houlleti, Metaphire posthuma, Eutyphoeus waltoni,* and *Eisenia fetida* [22].

Research conducted in Pondicherry region by A. Sathianarayanan and Anisa B. Khan, diversity and distribution were analyzed. They identified ten different species from five families. The identified species included- *Drawida willsi,*

Drawida limella, Drawida scandens, Pontoscolex corethurus, Lampito mauritii, Perionyx excavatus, Pontodrillus bermudensis, Octochaetona serrata, Octochaetona barnesi, and *Eudrilus eugeniae* [23]. In 2024 study conducted in Wildlife sanctuaries of West Bengal, Shakoor et al. identified total 22 species, while also highlighting parthenogenesis of *Metaphire houlltii* [24]. Recent research by Narayanan et al. (2024), conducted in the Western Ghat Biodiversity Hotspot. Documented three previously unknown earthworm species within the State of Kerala [25]. According to Chakraborty et al. (2023), the North east region of India is rich in earthworm diversity. Their findings cataloged a total of 234 species across eight states [26]. Following table contains distribution across such states.

Table 2. Shows earthworm distribution in North east region of India.

State	Number of species identified
Meghalaya	54
Arunachal Pradesh	52
Tripura	35
Sikkim	29
Assam	23
Manipur	17
Mizoram	15
Nagaland	9

In 2020, study conducted in Odisha by Acharya and Mishra, documented 10 different earthworm species across various locations. The researchers identified following species;

Lampito mauritii, Glyphidrillus tuberosus, Drawida willsi, Drawida celebi, Pheretima alexandri, Pellogaster bengalensis, Octochaetona barkudensis, Perionyx excaatus, Octochaetona serrata, Pontoscolex corethurus. In first sampling area (SA-1) *Glyphidrilus tuberosus* is most prevalent and in sampling area second (SA-2), *Drawida willsi* is the dominating species [27].

Bhari et al. (2024), Mapped the distribution of earthworm from family Lumbricidae across different states of India [28]. Chandran M.S. (2011), Conducted study within Nilgiri Biosphere reserve and documented 12 distinct earthworm species- *Drawida grandis, Drawida parva, Drawida travancorensis, Drawida sulcata, Drawida parambikulamana, Drawida robusta, unidentified Drawida spp., Argilophilus, Perionyx ceylanensis, Pontoscolex corethurus, Priodochaeta pellucida*, and *Amynthas corticis* [29]. In 2014 Shweta Yadav conducted a research on earthworm populations within India's Gangetic plains, and she recorded seven earthworm species distributed across five genera. Three species of *Eutyphoeus*, two of *Metaphire*, *Lampito* and *Polypheretima* [30]. In 2016 study conducted in Tripura by Animesh Dey identified earthworm species *Drawida assamensis* in pineapple agroecosystems [31].

Rinku Goswami and C.K. Mondal in their 2015 study, collected 505 distinct earthworms, identified six species. *Lampito mauritii, Metaphire posthuma, E. orienta, Amynthas diffringens, Dichogaster bolaui* [32]. Gudeta et al. (2022), identified seven distinct earthworm species in their study conducted in the Mid-Himalayan region. The

documented species included- *Amynthas corticis, Apporectodea rosea, Drawida japonica, Eisenia fetida, Metaphire birmanica, Metaphire houlleti,* and *Lennogaster pusilus* [33]. Hasan et al. (2023), documented the presence of nine species in their study on earthworm populations of Chhattisgarh. Identified species included- *Lampito mauritti, Metaphire houlrtti, Metaphire planata, Octochaetona surensis, Perionyx excavatus, Perionyx sansibaricus, Eisenia fetida,* and *Eudrilus eugeniae* [34].

Research led by Jing et al. (2021) in Nagaland, identified 12 distinct species of earthworms. The documented fauna included-*Amynthas corticis, Amynthas gracilis, Drawida assamensis, Drawida hodgarti, Drawida nepalensis, unidentified Drawida spp., Eutyphoeus assamensis, Eutyphoeus festivus, Metaphire houlleti, Peionyx excavatus, Perionyx simalensis,* and *Pontoscolex corethurus* [35]. Study conducted by John Joseph and colleagues (2019), collected earthworms across Kerala, and identified fourteen species. Genus Megascolex exhibited greatest variety, the genera *Metaphire, Perionyx*, and *Amynthas* each represented two species [36].

J. Kandpal (2018) conducted study on earthworm populations in Uttarakhand, he has collected 597 specimens [37]. Surkha Koul and D. Kocher (2016) observed *Metaphire posthuma, Metaphire penguana,* and *Lampito mauritii* [38]. Kumar and Tripathi (2015) examined how seasons affect earthworm populations (*Lampito mauritii*, *Amynthas morrisi*, and *Dichogaster bolaui)* [39]. Magare S.R. et al. (2019) conducted study in Satpuda mountain region (North Maharashtra), identified 244 earthworms across 16 collection sites. Most abundant species was *Eisenia fetida* and least abundant was *Drawida willsi* [40].

A significant proportion of Indian earthworm species are native, reflecting long-term evolutionary adaptation to local environmental conditions. However, the distribution and abundance of earthworm diversity across the country is uneven. The abundance of earthworms is heavily influenced by different seasons. In regions like Rajasthan and Punjab, populations of species such as *Dichogaster bolaui* and *Metaphire posthuma* peak during the rainy season. States such as Arunachal Pradesh, Meghalaya, Assam, and other north eastern regions exhibit high species richness due to favorable climatic conditions and habitat heterogeneity. In contrast, central and western regions, including Maharashtra, remain poorly explored, with limited published data on species composition and ecological distribution. Several studies have reported the dominance of species such as *Metaphire posthuma, Lampito mauritii, and Perionyx excavatus* across multiple regions, indicating their ecological adaptability and tolerance to habitat modification. Exotic species are frequently recorded in agricultural and urban landscapes, raising concerns regarding their impact on native earthworm communities.

5. Earthworm Diversity in Maharashtra:

Despite its diverse climatic zones and extensive agricultural landscapes, Maharashtra has received minimal scientific attention concerning earthworm diversity. Available studies are fragmented and localized, providing insufficient information on species richness, distribution patterns, and ecological functions. This lack of data limits effective soil biodiversity conservation and sustainable land management planning.

6. Potential Threats to Diversity

Species such as *Eisenia fetida, Eudrilus eugeniae* and *Perionyx excavates* are widely used for vermicomposting which converts organic waste into manure to increase crop yield.

Agrochemical Impact: Pesticides like carbamates, Monocrotophos and organophosphates are highly toxic to earthworms, reducing both biomass and reproductive rates.

Habitat Fragmentation: Rapid urbanization and land-use changes destroy the moist micro-habitats earthworms require.

Monoculture Farming: The lack of diverse organic matter in single-crop systems limits the food sources for various functional groups.

7. Conclusion

This review synthesizes available information on the diversity and distribution of earthworms at global and national levels, highlighting India as an important center of earthworm biodiversity. Although substantial progress has been made in documenting earthworm diversity in certain regions, significant knowledge gaps remain, particularly in Maharashtra. States like Kerala and Meghalaya show high species richness, others like Gujarat, Maharashtra and Bihar require more intensive investigation. The dominance of cosmopolitan species alongside limited documentation of native taxa underscores the need for systematic and region-specific studies. Future research should focus on comprehensive surveys, ecological assessments, and conservation strategies to enhance understanding of earthworm diversity and to promote sustainable soil management practices.

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