

EARTHWORM FAUNA OF RAJASTHAN: A REVIEW

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Abstract:

Earthworms are primary soil biota which has a dynamic potential for sustainable agriculture. These megadrili (Annelida: Clitellata) species are grouped into different ecological categories imparting to sustainability of pedoecosystem. A number of earthworm species have less reported from diverse ecological condition of Rajasthan. It embarks the need to review earthworm biodiversity. They are considered as an important soil bio-indicator. There are 18 species of earthworm. They belong to fifteen genera and five families (Megascolecidae, Ocnerodrilidae, Octochaetidae, Glossoscolecidae and Lumbricidae). Among them maximum number of earthworm species are from Megascolecidae and minimum from Glossoscolecidae family.

According to the researchers, earthworms likely increase greenhouse gas emissions several ways: they mix organic plant residues in the soil, which may increase decomposition and carbon dioxide emissions. The earthworm gut acts as a microbial incubator, boosting the activity of nitrous oxide and producing microbes. Carbon dioxide and nitrous oxide are greenhouse gases that increase the atmosphere's temperature, so contributing to climate change. In some soils, bacteria may lack organic matter, air, or water, and be less active. Earthworms can “wake up” bacteria by making organic matter, water, and air more available.

Keywords: Biodiversity, bio-indicator, endemic peregrine, exotic peregrine, megadrili

Introduction:

Earthworms are primary soil biota which has a dynamic potential for sustainable agriculture. These megadrili (Annelida: Clitellata) species are grouped into different ecological categories imparting to sustainability of pedoecosystem. A number of earthworm species have less

reported from diverse ecological condition of Rajasthan. It embarks the need to review earthworm biodiversity. They are considered as an important soil bio-indicator. There are 18 species of earthworm. They belong to fifteen genera and five families (Megascolecidae, Ocnerodrilidae, Octochaetidae, Glossoscolecidae and Lumbricidae). Among them maximum number of earthworm species are from Megascolecidae and minimum from Glossoscolecidae family.

Earthworms are major among the soil dwelling invertebrate groups and have been valued for their contribution to improving the fertility of agricultural lands for centuries. Earthworm aerate and mix soil and enrich the exhausted soil with their mucus and excreta and hence, improves soil biology, chemistry and physics. Aristotle (384-327 B.C.) termed this beautiful creature as 'Intestine of Earth.' Darwin (1881) named earthworm as 'Nature's ploughman and described his 40 years observation on this animals in his famous book '*The Formation of Vegetable Mould Through the Action of Worms*.

There are about 7254, described Oligochaete species and out of them about 3627 is a terrestrial earthworm in the world. In Indian subcontinent about 509 species belonging to 67 genera and 10 families has been reported, showing a high degree of diversity in this region as compared to other part of the globe (Julka, 1993a). There is several reports on earthworm biodiversity in different part of the country. Julka (1995) reported 42 species from 8 western. Himalayas districts. Bano and Kale (1991) reported earthworm biodiversity in southern Karnataka. Singh (1997) reported earthworm of some districts of Utter Pradesh. Blanchart and Julka (1997) reported earthworm fauna of virgin forests of western Ghats. Chaudhari and Bhattacharjee (1999) studied earthworm fauna of Tripura. Bhadauria *et al.* (2002) surveyed the earthworm diversity in central Himalays.

The earthworm fauna of Rajasthan has been explore by several workers (Stephenson, 1920 & 23, Gates, 1995, Julka, 1996, Handa, 1969, Bhardwaj, 2001, Suthar, 2002).

Now the importance of earthworm is being globally recognised, in the area of solid waste managements, detoxification, pollution monitoring, animal feed production and

land reclamation. According to the researchers, earthworms likely increase greenhouse gas emissions several ways: they mix organic plant residues in the soil, which may increase decomposition and carbon dioxide emissions. The earthworm gut acts as a microbial incubator, boosting the activity of nitrous oxide and producing microbes. Carbon dioxide and nitrous oxide are greenhouse gases that increase the atmosphere's temperature, so contributing to climate change. In some soils, bacteria may lack organic matter, air, or water, and be less active. Earthworms can "wake up" bacteria by making organic matter, water, and air more available

Diversity:

Stephenson (1920) firstly surveyed the soil of Rajasthan to find out the earthworm fauna of this region. He recorded 10 earthworm species viz. *Meptaphireposthuma*(Vaillant) from Ajmer and Udipur, *Amynthasmorrisi*(Beddard) from Udaipur, *Ramiellabishambari*(Stephenson) from Panchpahar, *Dichogaster, bolai*(Michaelsen) from Bayana (Bharatpur), *Aporrectodeacaliginosa trapezoid's* (Duges) from Mount Abu, *Allolobophoraparva*Eisen from Pratabgarh, *Ocnerodrilusoccidentalis*Eisen. from Kota, *Eutyphloeusincommodus*(Beddard) from Bharatpur, *Lampitomauritii*Kinberg from Banswara and *Eudichogasteashworthi*Michaelsen from Pratabgarh. (Table 1). Gates (1955) contributed two more earthworm species in earthworm fauna of Rajasthan viz *Octochaetonabeatrix*(Beddard) and *Eutyphoeuswaltoni*Michaelsen from Udipur. After Gates, Handa (1969) surveyed Jhunjhunu district of Rajasthan and reported a exotic peregrine species *Octochaetonabeatrix* (Bedd.) from Pilani region. Julka (1996) reported the earthworms from semiarid region of Rajasthan. He reported 3 earthworm species from Jodhpur belonging to two family viz. *Ramiellabishambari* (Stephenson), *Lempitomauritii*Kinberg and *Metaphireposthuma*(Vaillant). Recently, Bhardwaj (2001, unpub. Ph.D. Thesis) studied the earthworm, biodiversity of Jodhpur district of Rajasthan and reported total 9 species viz. *Metaphireposthuma* (Vaillant), *Lampitomauritii*Kinberg, *Dichogasterbolai*(Michaelsen), *Amynthasmorrisi* (Beddard)

Pontoscolexcorethrurus (Muller) *Perionyxsansibaricus* (Perrier)
Ocnerodrilusoccidentalis(Stephenson), *Octochaetonapaliensis*(Stephenson) and
Ramiellabishambari (Stephenson). Suthar (2002) firstly survey the Great Indian Thar desert including 11 district of Thar desert in Rajasthan, for earthworm diversity. He reported total 10 species from different desert district of Rajasthan (Table 1). In Suthar's study only 8 species were repeated as reported by previous workers except *Ramiellabishambari* in Jodhpur district and *O.beatrix* from Jhunjhunu district of Rajasthan. It can assume that these species has migrated or failed to survive or missed during samplings. The other possibilities are that during the survey these species under gone for quiescence or were deep in soil. Since, Suthar (2002) surveyed the Bikaner, Churu, Jalore, Jaisalmer, Barmar, Sri Ganganagar, Pali, Nagaur and Hanumangarh districts for first time and reported earthworm fauna of these districts of Rajasthan. Recently, Suthar (2003, unpublished data) reported *Amynthasmorrisi*(Bedd) from a sewage soil of Sri Ganganagar city of Rajasthan.

Presently earthworms fauna of Rajasthan comprised of total 16 species, belonging to 5 different families.

Distribution:

Rajasthan has a drastic variations in its soils, surface, natural vegetation, land use systems and cultivations practices. Most of its part about 61% of the total area of the state is under the cover of Great Indian Thar desert covering about 12 district of its. North -Western region. The archaenAravallis borders the Thar desert in east and Southern-east part of state is under the influence of tropical climate. Data indicates that the earthworms were not uniquely and showed patchy distribution only in some restricted habitats. The northern irrigated district of Thar Desert as well as central alluvial plain sub region's district seems to be rich in earthworm diversity and density. Most of the species in Rajasthan has been reported from man made habitats like house sewage, gardens, well irrigated agriculture plots, bank of canals, under tree canopy and in water riched soils of irrigation channels, tubewells, water tanks etc.

Several physical and chemical environmental factors have been suggested as determinants of the distribution and abundance of earthworms. These include available moisture, temperature, soil texture, soil depth, organic matter contents, C/N ratio, and pH of soil (Lee, 1985). Lavelle (1983 b) has stated that the structure of world earthworm community is mainly determined by the temperature.

According to curry (1992), temperature is a factor of primary importance in that it determines individual metabolic rates and in a global scale it can have a major role in determining patterns of earthworm distribution in soils. Optimal soil moisture content varies for different species and ecological categories and within species these appears to be a considerable capacity to adapt to least conditions (Lee, 1985).

Thus the climate of Rajasthan is characterised by high temperature and low availability water in soil. The desert soils are poor in organic matter contents. Julka (2001) summarized the distribution of earthworm in different agro-ecological zones of India. According to him the west coast plain and ghats region of India is considered earthworm mega diversity area (about 51.7% of the total known species harbours in this region). Similarly, wet evergreen tropical moist forest of eastern Himalayas and North- East hills are also considered are rich in earthworm bio resources (support about 27.4% of total earthworm species). In contrast to this Gujrat plain and hill region, Trans-Gangatic plain region (Punjab and Harayana), and Western dry region (Rajasthan) comprise of very poor earthworm diversity, possibly due to intensive cultivation and highly degraded soils in these areas.

Exotic/Endemic Species:

India harbours about 11.1% of the global earthworm diversity and about 402 species and sub species belonging to 66 genera and 10 families are found in India. 88.8% of the total earthworm diversity in the country is native (about 351 spp) and remaining 12.2% (about 45 spp.) are considered as peregrine for this region introduced presumably by men and other agencies in soil around roots of exotic plant (Gates, 1972, Julka, 1988).

In Rajasthan earthworm fauna is dominated by exotic peregrine species and out of the 16 recorded species, only four are native peregrine. The native peregrine earthworm species in Rajasthan are viz. *Lampitomauritii*, *Perionxysansibaricus*, *Ramiellabishambari* and *Octochaetona spp.* The exotic peregrine species mostly occurs in disturbed habitats, which have been created by deforestation and intensive cultivation of new areas. Successful colonisation of almost all agro climate zone in India by the exotic species is mainly due to their inherent ability to with stand disturbance and interference (Julka, 1988).

Drought and Earthworms in Rajasthan:

Rajasthan has close relationship with droughts in past long history. Rajasthan has experienced 40 droughts during the last 52-53 years. Since, soil moisture acts as a vital component for earthworm distribution in soils. Drought in having a serious impact on the surface vegetation, water levels and ultimately survival and dispersal of animals. In earthworm drought imposes such a prolonged negative effect on cocoon production, even often moisture condition have become favourable again. The juveniles are more sensitive to moisture contents in soils. However, it is possible that soil moisture has an important influence on food availability i.e. ingestion of food and soil may be easier with soil moisture might cause effects analogous to functional hypoxia because moderate reduction in soil moisture limited percutaneous O₂ diffusion, and thus reduced O₂ availability.

Since, earthworm have moderate morphological or physiological means for reducing water transport through the outside. Therefore, soil moisture is the most important environmental factor for the preferences and distribution of earthworm in soils. The surface dweller epigeic and endogeic earthworms are more subjected for death during surface soil drying even when no surface vegetation is present.

Future Research:

Large gaps exist in the knowledge of the earthworm biodiversity of the Rajasthan. Extensive study with particular reference to Eastern-south tropical part of Rajasthan

are expected to increase the number of earthworms considerably specially native peregrines. Urbanization, introduction of artificial canals in remote areas human migration and settlement initiations of cultivation on barren lands, transportation and improved soil conditions would be clearly enhanced earthworm fauna of Rajasthan.

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