

“Parasitic Species of Earthworms-A Review”.

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Abstract

It is well known that earthworms are useful for humans in many ways. An overview of the research work done so far in the past, shows that more than 7000 species are found world-wide. Out of them, some species are using for preparation of vermicompost with the help of various kinds of waste materials and cattle dung, which has proven to be a panacea for growing crops in the fields and increasing the fertility power of the soil. But never forget that some species of earthworms are not good for other animals. Because some species of earthworms passes their life as commensal animal in the cavities of other animals like on the surface of a fresh water bryozoan, *Plumatella repens* var. *emarginata* and some are parasitic on several fresh water snails and sponges. In the present research paper, some harmful species of earthworms have been described which already been identified long time ago i.e. in the nineteenth century by Stephenson and some other researchers in India and abroad. Thereby, in the present review article, fifteen species of earthworms belonging to two families i.e. *Naididae* and *Enchytraeidae* have been described which living as a parasites on several species of other animals like - snails, bryozoans and sponges.

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I. Introduction

Research work on the usefulness of earthworms and type of species has been done in the past by different researchers. They are extensively used either as fish feed (Dash *et al.*, 1977; Sabine, 1978; Kale, 1986; Julka, 1986), fish bait (Tomlin, 1983), poultry feed (Dash *et al.*, 1977; Yoshida & Hoshi, 1978; Knieriemen, 1985; Bano and Kale, 1986; Julka, 1986) or as a suitable protein feed in piggeries (Sabine, 1983). There have been many reports of earthworms being eaten by humans as medicines to cure different diseases like- bladder stone, fever, small pox, post portal weakness (Reynolds and Reynolds, 1972). Earthworms ashes have been used as a tooth powder in primitive societies (Stephenson, 1930). Apart from this, ayurvedic as well as Unani medicines are also made from earthworms for the treatment of various types of diseases. In Ayurveda and Unani systems of medicine (India) the paste of dried worms has been recommended for the treatment of wounds, chronic boils, piles, chronic cough, sore throat, teeth diseases, hernia, impotency, small pox, smooth delivery, gall bladder stone, hair growth, diphtheria, jaundice, fever, rheumatic pains, tuberculosis, bronchitis, facial paralysis, scorpion and snake bite *etc.* (Agrawal, 2009). Currently, various epigeic species of earthworms such as - *Eisenia fetida*, *E. andrei*, *Eudrillus eugeniae*, *Dendrobaena veneta*, *Perionyx excavates*, *P. sansibaricus*, *Drawida willsi*, *Lumbricus rubellus*, *Polypheretima elongata*, *Ramilla bishambari*, *Lampito mauritii*, *Metaphire anomala*, *M. houlleti*, *M. birmanica*, and some others, have been used for transformation of different biodegradable wastes (domestic waste, agricultural waste, hospital waste & municipal solid wastes *etc.*) into useful vermicompost, which is very useful to plant growth.

In short, it can be said that earthworms have many benefits. But despite all this, there are some species of earthworms which are harmful to some other animals because they live in their body as a parasites, due to which the hosts face various kinds of physiological problems. Due to these, various types of deformities and diseases occur in the host animals which are sometimes become the cause of their death. In view of the literature cited above, it is clear that a lot of work has been done on the usefulness of earthworms in various ways by different researchers, but nobody try to do some work on the harmfulness as well as harmful activities of earthworms till now. Therefore, keeping this in mind, the current review report on parasitic species of earthworms was evaluated and presented.

II. Results & Discussion

Spongilla carteri sp. noticed as a very suitable host sp. for most of the worm's species. Because most of the parasitic species of earthworms viz., *Caetogaster spongillae*, *Nais communis* var. *punjabensis*, *Nais communis* var. *caeca*, *Nais elinguis*, *Nais pectinata*, *Pristina longiseta*, *Pristina aequiseta* and *Pristina proboscidea*, prefer to live as a parasite on *Spongilla carteri* (a fresh water sponge). Second suitable host species was recorded *Plumatella emarginata* (a fresh water bryozoan, which is also known as 'fresh water moss

animal’) on which few parasitic species of earthworms prefer to live them. Because many worm’s species like - *Caetogaster spongillae*, *Caetogaster sp.*, *Nais elinguis*, *Pristina longiseta*, *Pristina proboscidea* and *Salvina appendiculata*, living as a parasite on *Plumatella emargineta*. Although, few species of earthworms viz., *Pristina longiseta*, *Pristina proboscidea*, and *Caetogaster spongillae* living along with *Spongilla crassissima* and some (*Pristina longiseta*, *Pristina proboscidea* var. *paraguayensis*) with *Plumatella fruticosa* (a fresh water bryozoan). However, Genus *Caetogaster*, *Caetogaster limnaei* and *Enchytraeus indicus* are living in few species of snails. In addition, *Caetogaster spongillae sp.* of earthworms feeds on the organic debris of the decaying parts of several sponges and bryozoans like - *Spongilla carteri*, *Spongilla decipiens*, *Plumatella repens* var. *emargineta* and *Spongilla carteriformis* (Table -1).

Table -1: Showing Name of the hosts for earthworm species.

Sl. No	Name of worm's species	Distribution	Name of the host
1.	Genus <i>Chaetogaster</i> (K. Baer.)	India	Fresh water snails & sponges
2.	<i>Chaetogaster annadalei</i> (Steph.)	India, Japan	Sponges, Ephydatia fluvitilis
3.	<i>Chaetogaster limnaei</i> (K. Baer.)	India	Fresh water snails, Ephydatia fluvitilis
4.	<i>Chaetogaster spongillae</i> (Annand.)	India	<i>Spongilla carteri</i> , <i>Spongilla decipiens</i> , <i>Plumatella repens</i> var. <i>emarginata</i> & <i>Spongilla carteriformis</i> .
5.	<i>Chaetogaster sp.</i>	India	<i>Plumatella repens</i> var. <i>emarginata</i> .
6.	<i>Nais communis</i> (Piguet.) var. <i>punjabensis</i> (Steph.)	India, Pakistan, E. Persia, Switzerland	<i>Spongilla carteri</i>
7.	<i>Nais communis</i> (Piguet) var. <i>caeca</i> (Steph.)	India	<i>Spongilla carteri</i>
8.	<i>Nais elinguis</i> (Mill., Orst.)	India, widely spread in Europe	<i>Spongilla carteri</i> , <i>Plumatella emargineta</i> .
9.	<i>Nais pectinata</i> (Steph.) var. <i>inaequalis</i> (Steph.)	India	<i>Spongilla carteri</i>
10.	<i>Pristina longiseta</i> (Ehrbg.,of. typica)	India, Pakistan, N. America, widely distributed in Europe	<i>Spongilla carteri</i> , <i>Plumatella emargineta</i> , <i>Plumatella fruticosa</i> , <i>Spongilla crassissima</i> .
11.	<i>Pristina aequiseta</i> (A.G.Bourne)	India and also distributed in Europe	<i>Spongilla carteri</i>
12.	<i>Pristina proboscidea</i> (Bedd.f.typica)	India, Zanzibar, Paraguay and Java.	<i>Spongilla carteri</i> , <i>Spongilla crassissima</i> .
13.	<i>Pristina proboscidea</i> var <i>paraguayensis</i> (Mich.)	India, also in Paraguay.	<i>Plumatella fruticosa</i> , <i>Plumatella emargineta</i> .
14.	<i>Salvina appendiculata</i> (Udek.)	India, Pakistan. It is a common European sp.	<i>Plumatella emargineta</i> .
15.	<i>Enchytraeus indicus</i> (Steph.)	India only	Pond snails.

All the parasitic earthworm species described in the present paper are found in India. Of these, *Caetogaster annadalei* is found in India as well as Japan. While *Nais communis*, *Pristina longiseta*, and *Salvina appendiculata* are found in India as well as Pakistan and Europe. Among these, *Nais elinguis*, *Pristina longiseta*, *Salvina appendiculata* are widely distributed species in Europe. *Nais communis* is found in E. Persia while *Pristina aequiseta* has also been reported in Europe and *Pristina proboscidea* has been reported from Zanzibar, Paraguay and Java besides India. The remaining worm's species include *Pristina proboscidea* var *paraguayensis*, distributed in Paraguay apart from India and *Enchytraeus indicus*, *Nais pectinata*, *Nais communis* var. *caeca*, *Caetogaster sp.* *Caetogaster spongillae*, *Caetogaster limnaei* & Genus *Caetogaster* found

only in India (see Table -1). However, many researchers have worked on earthworms, and have explained their usefulness in detail. Some people discussed about the method for preparing vermicompost using different varieties of earthworms (Ganihar, 1996; Garg & Bhardwaj, 2000; Kale & Krishnamoorthy, 1981; Mudgal *et al.*, 2006; Radhakrishna, 2007; Singh *et al.*, 2010; Prakash, 2011....), while some discussed that ayurvedic as well as Unani medicines can also made from earthworms for the treatment of various types of diseases (Stephenson, 1930; Reynolds and Reynolds, 1972; Sabine, 1983; Afreen & Shaikh, 2020) and some did research work on their species diversity in various parts of the country and abroad (Agrawal & Agrawal, 2009; Bandyopadhyay *et al.*, 2008; Blakemore *et al.*, 2006; Prakash, 2017; Sathianarayanan & Khan, 2006; Singh and Prakash, 2012; Verma *et al.*, 2010; Paliwal & Julka, 2005; Julka, 1986; Gates (1940, 1972....). But it should also not be forgotten that some species of earthworms can also be harmful to other animals, as described in the present research paper. Although, no one has described in their research that earthworms are harmful to human beings till now. This research paper makes it clear that extensive research work is needed on this direction in the future. If new research reveals some harmful activities of earthworms for human beings and other animals, then the current research article will certainly prove to be a milestone.

The details of the parasitic species of earthworms, their distribution and different host species for earthworms are as follows -

1. Genus *Chaetogaster* (K. Baer.)

Habitat and Distribution: This genus is carnivorous, sometimes vegetable feeder. The majority of Indian species are parasitic on and in fresh water snails and sponges (Stephenson, 1923). This genus is world wide in distribution. It distributed in Punjab (Lahore; Gurdaspur district); Bengal (Calcutta); United provinces (Agra); Burma (L. Inle.); N. W. fromteier province; Western Ghats; W. Himalayas (Nainital).

2. *Chaetogaster annadalei* (Steph.)

1918. *Chaetogaster annadalei*, Stephenson, Rec. Ind. Mus. xiv, p.9.

1917. *Chaetogaster annadalei*, Stephenson, Mem. As. Soc. Bengal, vi, pp. 85-88.

1923. *Chaetogaster annadalei*, Stephenson, Fauna of British India (Oligochaeta), pp.49-50.

Habitat and Distribution: The species was originally described from Japan, where it was found in a sponge. It distributed in Lake Inle, S. Shan States, Burma; in a sponge, *Ephydatia fluviatilis*.

3. *Chaetogaster limnaei* (K. Baer.)

1909. *Chaetogaster limnaei*, Michaelsen, Mem. Ind. Mus. i, p.131.

1918. *Chaetogaster limnaei*, Stephenson, Rec. Ind. Mus. xiv, p.9.

1920. *Chaetogaster limnaei*, Stephenson, Mem. Ind. Mus. vii, p.195.

1923. *Chaetogaster limnaei*, Stephenson, Fauna of British India (Oligochaeta), pp. 50-51.

Habitat and Distribution: Parasitic in fresh water snails. It distributed in Nainital, W. Himalayas (Dr. Annandale informs to Stephenson (1923) that these specimens were found on a *Limnaea*); ? Inle lake, Burma (on *Ephydatia fluviatilis*). This is a widely distributed European species, commensal on or parasitic in fresh water snails.

4. *Chaetogaster spongillae* (Annand.)

1906. *Chaetogaster spongillae*, Annandale, Journ. & Proc. As. Soc. Bengal, ii, p.188, text -fig. I A.

1907. *Chaetogaster spongillae*, Stephenson, Rec. Ind. Mus. i, p. 248.

1911. *Chaetogaster spongillae*, Stephenson, Rec. Ind. Mus. vi, p.205. text -fig. 1.

1920. *Chaetogaster spongillae*, Stephenson, Mem. Ind. Mus. vii, p.195.

1923. *Chaetogaster spongillae*, Stephenson, Fauna of British India (Oligochaeta), pp. 52-53.

Habitat and Distribution: The animal feeds on the organic debris of the decaying parts of sponges, and is not found in the healthy growing parts. It distributed in Calcutta, in *Spongilla carteri* and *Spongilla decipiens*, and on *Plumatella repens* var *emarginata*; Khandala, W. Ghats, in *Spongilla carteriformis*.

5. *Chaetogaster* sp.

1906. *Chaetogaster* sp., Annandale, Journ. & Proc. As. Soc. Bengal, ii, p.189, text -fig. 1 B.

1907. *Chaetogaster* sp., Stephenson, Rec. Ind. Mus. i, p.248.

1923. *Chaetogaster* sp., Stephenson, Fauna of British India (Oligochaeta), pp.53.

Habitat and Distribution: As a parasitic or commensal life in the cavities of other animals. The food consists, in part at least of Protozoa which are abundant on the water surface. It distributed in Calcutta; on the surface of *Plumatella repens* var *emarginata*.

6. *Nais communis* (Piguet.) var. *punjabensis* (Steph.)

1909. *Nais communis* var. *punjabensis*, Stephenson, Mem. Ind. Mus. i, p. 255, text -figs. 1-3, pls. xv-xxii, figs. 1-21.

1909. *Nais communis* var. *punjabensis*, Piguet, Rev. Suisse Zool. xvii, p.198, text -fig.

1910. *Nais communis* var. *punjabensis*, Stephenson, Mem. Ind. Mus. v, p.66, pl. viii, figs. 1-2.

1910. *Nais communis* var. *punjabensis*, Stephenson, Rec. Ind. Mus. v, pp.237, 239, 240, pl. xi, figs. 2,4.

1913. *Nais communis* var. *punjabensis*, Stephenson, Tr. Roy. Soc. Edin. xlix, pp. 737, 744, 758.

1915. *Nais communis* var. *punjabensis*, Stephenson, Tr. Roy. Soc. Edin. 1, p. 786.

1918. *Nais communis* var. *punjabensis*, Stephenson, Rec. Ind. Mus. xiv, p. 12.

1920. *Nais communis* var. *punjabensis*, Stephenson, Mem. Ind. Mus. vii, p. 196.

1920. *Nais communis* var. *punjabensis*, Mehra, P. Z. S. p. 457.

1923. *Nais communis* var. *punjabensis*, Stephenson, Fauna of British India (Oligochaeta), pp. 55-57.

Habitat and Distribution: The worm has been found inhabiting tubes, probably abandoned by insect larvae; specimens found by Annandale in Seistan were living in relatively long mucilaginous tubes, to which colonies of the polyzoan *Lophopodella* had attached themselves. It distributed in Lahore; Peshawar; Kasauli, W. Himalayas; Agra; Khandala, W. Ghats; Bheemanagar, Travancore (in *Spongilla carteri*). Also in Seistan, E. Persia. The type form of the species has been found as far apart as Patagonia and Switzerland.

7. ***Nais communis* (Piguet) var. *caeca* (Steph.)**

1910. *Nais communis* var. *caeca*, Stephenson, Rec. Ind. Mus. v, pp. 235, 238, pl. xi, fig. 3.

1918. *Nais communis* var. *caeca*, Stephenson, Rec. Ind. Mus. xiv, p. 12.

1923. *Nais communis* var. *caeca*, Stephenson, Fauna of British India (Oligochaeta), pp. 57-58.

Habitat and Distribution: It is living as a parasite in *Spongilla carteri*. Body length about 02 mm. It distributed in Bheemanagar, Travancore (in *Spongilla carteri*); Kasauli, W. Himalayas.

8. ***Nais elinguis* (Mill., Orst.)**

1909. *Nais elinguis*, Michaelsen, Mem. Ind. Mus. i, p. 131.

1903. *Nais elinguis*, Michaelsen, Jahrb. Hamb. wiss. Anst. xix, p. 175, fig. 4.

1906. *Nais elinguis*, Piguet, Rev. Suisse Zool. xiv, p. 241, pl. x, fig. 8, pl. xi, figs. 8-13, pl. xii, fig. 10.

1923. *Nais communis* var. *elinguis*, Stephenson, Fauna of British India (Oligochaeta), pp. 58-59.

Habitat and Distribution: It is small species, body length upto 1.2-10 mm. Distributed in Calcutta, in *Spongilla carteri*; ? Alipur, near Calcutta, from colonies of *Plumatella emarginata*. Widely spread in Europe.

9. ***Nais pectinata* (Steph.) var. *inaequalis* (Steph.)**

1911. *Nais pectinata* var. *inaequalis*, Stephenson, Rec. Ind. Mus. vi, p. 208, text -fig. 2.

1920. *Nais pectinata* var. *inaequalis*, Mehra, P. Z. S. pp. 457, 458, text -figs. 1 A, 2.

1923. *Nais communis* var. *inaequalis* Stephenson, Fauna of British India (Oligochaeta), pp. 64-65.

Habitat and Distribution: It is distributed in Agra, Bheemanagar, Travancore (in *Spongilla carteri*), along with the type form of the species. It about 15-18 mm in length.

10. ***Pristina longiseta* (Ehrbg., f. typica)**

1909. *Pristina longiseta*, Michaelsen, Mem. Ind. Mus. i, p. 135.

1909. *Pristina longiseta*, Stephenson, Mem. Ind. Mus. i, p. 264, text -figs. 4, pl. xvii, fig. 25, pl. xviii, figs. 26-33, 38.

1909. *Pristina longiseta*, Piguet, Rev. Suisse, Zool. xvii, pp. 212, 216.

1910. *Pristina longiseta*, Stephenson, Rec. Ind. Mus. v, p. 325.

1913. *Pristina longiseta*, Stephenson, Tr. Roy. Soc. Edin. xlix, pp. 739, 744.

1916. *Pristina longiseta*, Stephenson, Rec. Ind. Mus. xii, p. 304.

1920. *Pristina longiseta*, Stephenson, Mem. Ind. Mus. vii, p. 199.

1920. *Pristina longiseta*, Mehra, P. Z. S. p. 457.

1884. *Pristina longiseta*, Vejdovsky, Monog. p. 31, pl. ii, figs. 13-15.

1895. *Pristina longiseta*, Beddard, Monog. p. 290.

1906. *Pristina longiseta*, Piguet, Rev. Suisse, Zool. xiv, p. 290, pl. x, figs. 22-23, pl. xii, figs. 21-25.

1913. *Pristina longiseta*, Piguet, Olig. Suisse, p. 50.

1923. *Pristina longiseta*, Stephenson, Fauna of British India (Oligochaeta), pp. 70-71.

Habitat and Distribution: It is a another parasitic Species distributed in Calcutta, in *Spongilla crassissima* and from colonies of *Plumatella fruticosa* and *Plumatella emarginata* (oral communication from Dr. Annandale, emending the original statement); Lahore; Bheemanagar, Travancore (on or in *Spongilla carteri*); Bombay; Gwalior, central India. Widely distributed in Europe; found also in N. America.

11. ***Pristina aequiseta* (A.G.Bourne)**

1909. *Pristina aequiseta*, Michaelsen, Mem. Ind. Mus. i, p. 134.

1909. *Pristina aequiseta*, Stephenson, Mem. Ind. Mus. i, p. 269, text -fig. 5, pl. xviii, fig. 34.

1909. *Pristina aequiseta*, Piguet, Rev. Suisse, Zool. xvii, pp. 212, 216.

1915. *Pristina aequiseta*, Stephenson, Tr. Roy. Soc. Edin. 1, p. 786.

1916. *Pristina aequiseta*, Stephenson, Rec. Ind. Mus. xii, p. 304.

1891. *Pristina aequiseta*, Bourne, Quart. J. Mic. Science. xxxii, p. 352.

1895. *Pristina aequiseta*, Beddard, Monog. p. 291.

1906. *Naidium tentaculatum*, Piguet, Rev. Suisse, Zool. xiv, p. 219, pl. ix, figs. 18-20 & 26.

1913. *Pristina aequiseta*, Piguet, Olig. Suisse, p. 52.

1923. *Pristina aequisetata*, Stephenson, Fauna of British India (Oligochaeta), pp. 71-73.

Habitat and Distribution: It is distributed in Calcutta (in *Spongilla carteri*); Lahore; Allahabad. Also found in Europe. It is upto 2-3 mm in length.

12. *Pristina proboscidea* (Bedd. f. typica)

1909. *Pristina proboscidea* f. *typica*, Michaelsen, Mem. Ind. Mus. i, p. 133.

1911. *Pristina proboscidea* f. *typica*, Stephenson, Rec. Ind. Mus. vi, p. 211.

1896. *Pristina proboscidea*, Beddard, Ergeb. Magalh. p. 4, fig. 18.

1905. *Pristina proboscidea* f. *typica*, Michaelsen, Zoologica, xlv, p. 359.

1923. *Pristina proboscidea*, Stephenson, Fauna of British India (Oligochaeta), pp. 73.

Habitat and Distribution: Calcutta (in *Spongilla crassissima* and *S. carteri*, also living freely). Recorded also from Zanzibar, Chile (Valparaiso), Paraguay, and Java.

13. *Pristina proboscidea* var. *paraguayensis* (Mich.)

1909. *Pristina proboscidea* var. *paraguayensis*, Michaelsen, Mem. Ind. Mus. i, p. 134.

1905. *Pristina proboscidea* var. *paraguayensis*, Michaelsen, Zoologica, xlv, p. 360.

1923. *Pristina proboscidea* var. *paraguayensis*, Stephenson, Fauna of British India (Oligochaeta), pp. 73-74.

Habitat and Distribution: Calcutta (from colonies of *Plumatella fruticosa* and *Plumatella emarginata*). Also in Paraguay. Length upto 0.55 mm.

14. *Salvina appendiculata* (Udek.)

1909. *Salvina appendiculata*, Michaelsen, Mem. Ind. Mus. i, p. 132.

1909. *Salvina punjabensis*, Stephenson, Mem. Ind. Mus. i, p. 272, pl. xviii, figs. 35-37, pl. xix, figs. 41-45, pl. xx, figs. 50-52.

1913. *Salvina punjabensis*, Stephenson, Tr. Roy. Soc. Edin. xlix, pp. 737, 744, 757.

1913. *Salvina appendiculata*, Michaelsen, Mem. Soc. Neuchatel. v, p. 207.

1915. *Salvina punjabensis*, Stephenson, Tr. Roy. Soc. Edin. 1, p. 793, plate. lxxx, figs. 4, 5.

1916. *Salvina punjabensis*, Stephenson, Rec. Ind. Mus. xii, p. 302.

1855. *Nais appendiculata*, d'Udekem, Bull. Ac. Belgique, xxii, p. 552, fig. 3.

1884. *Salvina appendiculata*, Vejdovsky, Monog. p. 30, pl. iii, figs. 17-26.

1895. *Nais appendiculata*, Beddard, Monog. p. 287.

1903. *Salvina appendiculata*, Michaelsen, Jahrb. Hamb. wiss. Anst. xix, p. 185.

1906. *Salvina appendiculata*, Piguët, Rev. Suisse Zool. xiv, p. 282, pl. xii, fig. 20.

1923. *Salvina appendiculata*, Stephenson, Fauna of British India (Oligochaeta), pp. 82-83.

Habitat and Distribution: Alipur, near Calcutta, from colonies of *Plumatella emarginata*; Lahore, free - living. A common European species. Length upto 2-8 mm.

15. *Enchytraeus indicus* (Steph.)

1912. *Enchytraeus indicus*, Stephenson, Rec. Ind. Mus. vii, p. 238, pl. xii, fig. 6.

1923. *Enchytraeus indicus*, Stephenson, Fauna of British India (Oligochaeta), pp. 115.

Habitat and Distribution: The worms were found in the egg-membranes of the pond-snails *Ampullaria*. The species reported by Stephenson (1923) in and around Bombay region only. Length upto 4 mm.

III. Conclusion

There is no doubt that earthworms have proved to be very useful for humans because at present earthworms are used to produce vermicompost, vermifish, vermifilters, pesticide solutions, etc. Along with this, various types of Ayurvedic medicines are also made from earthworms. Which are used in the treatment of various types of diseases. But some species of earthworms living symbiotically in the cavities of other animals like several species of aquatic snails ; while some species have also been reported which are carnivorous. Among these, *Chaetogaster orientalis* (Steph) and *Chaetogaster* genus (K. Baer.) are especially well known examples of these species. These species devouring small crustacea, rotifers, small nematodes, ciliates such as *Paramecium* and other small worms. Some species of the *Chaetogaster* genus have also been reported to be vegetable feeders. Therefore, it is very necessary to research on the usefulness of earthworms, their benefits as well as the harm caused by them. Through this research paper, I want to appeal to new researchers who working on these lines to increase their research in this direction. I not only hope but have full confidence that some good results will definitely emerge in the future and it will help in understanding earthworms in well manners.

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