ISSN 0974-9152

VERMECO

Bulletin of the Academic Forum SEEER
&
(The Centre for Vermiculture & Vermicomposting of the University)

VOL. 12(1&2) January/July 2019

Editorial

Sui generis Earthworms

Since times immemorial earthworms are unparalleled annelid creatures. It is not only because of their immense role in bio-turbation, bio-irrigation, bio-aeration, bio-stabilization, bio-remediation processes in the soils and for the bio-transformation of organic wastes into bio- manure but for their peculiar and different anatomical manifestations. It has already been known that the most receptive anterior part - the prostomium, the most absorptive part of the gut - the typhlosole and the most posterior part - the anus, are morphologically and histologically different in different species of earthworms.

It is also known that the castings-production-potentiality (CPP) of different earthworm species is found different. In a study, the CPP of the earthworm, *Eutyphoeus waltoni* was found more than that of *Metaphire posthuma*. At pH 5.9, *E. waltoni* produces 8.6 times castings than that of *M. posthuma*; while at pH 7.6, such a ratio between *E. waltoni* and *M. posthuma* is 2.6:1. These two worms showed diversified soil-preferences too. *M. posthuma* produces more castings in the soil having pH 7.6; while *E. waltoni* produces more castings in the acidic soil (pH 5.9). An extensive work was further conducted on the food-retention-time (FRT) of these worms to investigate such a major variation in the production of worm- castings and it was found that the FRT of *M. posthuma* was 1.7 times more than that of *E. waltoni*.

Why FRT of earthworms is different? A scanning electron microscopic (SEM) study of the typhlosolar and anal regions of the gut of these two species of earthworms was conducted to explore the reasons of such alterations. In one of the present articles of the bulletin entitled, **"Why castings of different earthworm species are of different size and shape?"**, the facts about the structural variations in the gut of these two worms responsible for such changes in size, shape, amount and moisture content of their castings - the faecal matter were explained.

In other article, **"Source of iron in the Haemoglobin of earthworms"** is explained and discussed. The findings are based upon the X-ray diffraction study of different soil samples before and after passing through the gut of these two earthworms.

Prof. S.M. Singh

Message from the President

In nature all is not known and whatever is known today was unknown in the past. There is always a sharp gap between known and unknown and the research is such an innovative process that minimizes the gap. This is true not only for plants but animals too. The Earthworm Laboratory of the Department of Animal Science of the University is working on such aspects. Both the articles of the bulletin reflect the findings of such innovative work carried out for the first time on earthworms. Hope these articles must reduce the gap between known and unknown facts of these earthworms.

Prof. Anil Shukla
Vice Chancellor
Mahatma Jyotiba Phule Rohilkhand
University, Bareilly (India)

Uncovering the Truth - 1

Why castings of different earthworms are of different size and shape?

Castings-the faecal matter, of different species earthworms are of different size and shapes. In *Metaphire posthuma*, a common Indian earthworm (Fig.1), it is pellet like (Fig.2); while in *Eutyphoeus waltoni* - a rain worm (Fig.3), tower like (Fig.4).

Fig. 1: *M. posthuma*

Fig. 2: Castings of *M. posthuma*

Fig. 3: *E.waltoni*

Fig. 4: Castings of *E.waltoni*

In a Scanning Electron Microscopic study of the part of the gut bearing typhlosole of both the earthworm species, the luminal portion of the intestine of *M. posthuma* has revealed the presence of very large number of microvilli on its surface (Fig.5). The microvilli appear to be in a small and large sized and in polygonal areas. It has also been noted that there is no topographical difference between the typhlosolar and non-typhlosolar areas of the intestine. In the last part of the alimentary canal, the number of microvilli was reduced as compared to those found on or near the typhlosole.

In contrast to the above picture, the luminal surface of the intestine of *E. waltoni* was covered with large number of cilia (Fig. 6). These are obviously several times bigger than the microvilli seen in *M. posthuma*. The cilia appeared to have been fixed in a manner reflective of their metacronous beating. At few places, cilia are either missing or less in number. At such places, several inter-ciliary pores are also visible. Size of the cilia would not be measured precisely as these were seen in a surface view.

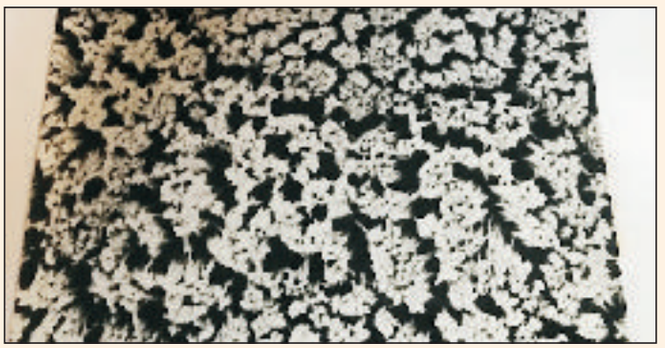

Fig. 5: *A portion of luminal surface of the Typhlosolar region showing microvilli at a higher magnification (x6000)*

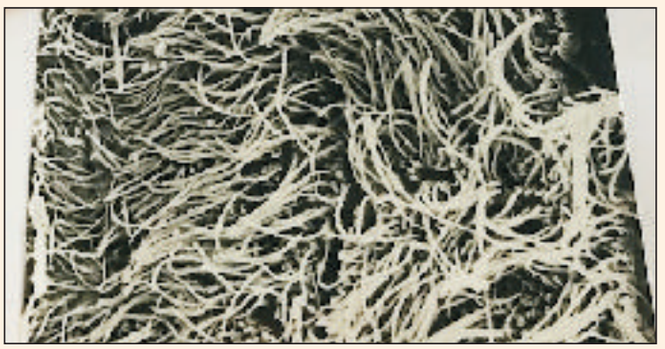

Fig. 6: *A portion of luminal surface of the Typhlosolar region showing cilia at a higher magnification (x4000)*

Fig. 7: ***Showing posterior end-on-view of M. posthuma (x30)***

Fig. 8: ***Showing posterior end-on-view of E. waltoni (x36)***

These findings indicate that why the castings of *M. posthuma* are round, hard, distinctly pellet like and with less quantity of moisture as compared to the castings of *E. waltoni* which are soft and vermicelli-like having nearly 1.5 times more moisture in them. In other words, microvilli found on the luminal layer of the intestine of *M. posthuma* help in absorbing water, which is present not only in the ingested soil and the gut secretions but also in the extra fluid brought in to the gut by the enteronepheric nephridia. In *E. waltoni*, the level of water absorption, if any, must be minimal because of apparent absence of microvilli and presence of cilia in instead. Moreover, it is known that no extra excretory fluid is brought in to the gut in these worms, as the nephridia are exonepheric. It appears that the large number of cilia present on the intestinal luminal surface of *E.waltoni* help in pushing the ingested soil at a faster rate than in *M. posthuma*. It may be one of the other reasons that the castings of *M. posthuma* are round , hard, distinctly pellet-like and with less quantity of moisture content as compared to the castings of *E. waltoni*, which are soft and string or vermicelli-like, having 1.5 times more moisture in them. Production of more amounts of castings by *E. waltoni* than that of *M. posthuma* is because of faster pushing movement of the cilia in their gut.

Another reason why the castings are thrown out in the form of tiny beads in case of *M. posthuma* and tower like in *E. waltoni* is that the anal morphology was also different in both the worms. The shape of anal aperture of *M. posthuma* is slit like (Fig.7); while that of *E. waltoni* is nearly oval (Fig.8). This aperture is about 2.3 times wider in *E. waltoni* than that of *M. posthuma*. **Although, at this stage it is not possible to understand whether such a difference was simply reflecting different anatomical specializations, or it was a consequence of functional modifications of their sphincters.**

S.M. Singh-Professor of Earthworm Biology, Mahatma Jyotiba Phule Rohilkhand University, Bareilly

Uncovering the Truth-2

Source of 'Fe' in the Haemoglobin of Earthworms

Iron (Fe) is one of the important constituent of haemoglobin in the blood of animals. Fruits and vegetables are considered as the chief sources of it. In earthworms, it is still a question to know its source as these creatures are soil feeders. In X-rays diffraction study, three soils of different pH (5.9, 7.8 and 8.4) were taken for two endogeic species of earthworms, *Metaphire posthuma and Eutyphoeus waltoni* to analyze their mineralogical spectrum before and after passing through their gut. The samples of soils and respective fresh castings of both species of earthworms were exposed to X-ray diffractometer (PW-1730) fitted with vertical goniometer M/S Philips, Holland. The rating of the X-ray tube was kept to be 40KV/200 mA and FeK radiations were used for obtaining X-ray diffraction patterns on a chart recorder. The diffraction peaks were recorded and interpreted for all the samples of soils and respective castings of both the earthworm species.

Findings indicate that the mineralogical picture of the parent soils altered considerably while it traversed through the gut of the earthworms except the mineral Quartz (SiO_2) which was passed unchanged in its amounts. Further it was also noted that the mineral Hematite - an oxide of iron (Fe_2O_3), whenever present in the parent soil was found missing in the castings of both species of earthworms. Although it would be necessary to carry out further experiments to ascertain the pathways for the mobilization of iron, it appears highly probable that the **worms utilize hematite whenever it is available to them for its incorporation in the haem part of the heamoglobin present in the blood vascular system of these worms.**

KNOW OUR PROGRESSIVE FARMERS

Mahendra Singh (Cell - 9412540840)

Shri Mahendra Singh- is a graduate farmer from the village Aimi, post Gahluiya, District-Pilibhit (Uttar Pradesh State). He is engaged in agriculture since past 35 years using most of the modern technologies in farming. He sows wheat with ferti seed drill and Happy Seeder machine and cultivates wheat, paddy, peas, summer moong, etc. with the help of other farmers. A total of 100 farmers from nearby villages have been associated with him for seed production of wheat on 1,000 acre, paddy/basmati on 250 acre and summer moong on 25 acre of land. He has never burnt paddy straw and has installed a biogas plant in his field.

In addition, he has adopted dairy farming as a subsidiary occupation with 5 cows and 2 buffaloes. He is a source of inspiration for other farmers too. Shri Singh is a progressive dairy farmer of the village. Before 2001 Shri Singh preferred Natural Science for artificial insemination for breeding of cows and buffaloes. His attitude towards the AI practice was very poor. However, with regular meetings and motivation over the period of time, he agreed for artificial insemination in cows and buffaloes. He was particularly trained by scientists and technical officers of the KVK to observe and identify heat symptoms correctly so that timely insemination could be done. Slowly and over the years the results were very encouraging for him.

Today he has totally different views about artificial insemination and advocates the same to the all villagers. At present, he has 7 cows and buffaloes of different categories. Out of this, he has 4 pregnant cows and 2 heifers. He is also earning lot of money through sale of these animals. He is using the dung and other wastes of these animals for making of farm yard manure. By the use of these dung and vermi-manure, he is getting his soils rich in organic matter which is giving him more quality production of crops.

Indian earthworm Biologist-14

Prof. S. Umamaheswari (b.1976)

Dr. Umamaheswari is working as Professor in the Department of Biotechnology, Manonmaniam Sundaranar University, Tirunelveli (TN). She obtained her M.Sc. Degree in Microbiology from Sri Paramakalyani College of Arts and Science, Alwarkurichi in 1998 and Ph.D. in Microbiology / Environmental Sciences from Manonmaniam Sundaranar University, Tirunelveli in 2003.

Dr. Umamaheswari has 14 years of research experience and teaching of UG and PG classes. She has supervised 09 Ph.D. students and 07 are still working. She guided 19 M.Phil. students. She has completed 07 major research projects and published more than 53 research papers in various International and National journals 18 lucid articles in different news papers and Kisan magazines and 06 AIR radio talks.

Dr. Umamaheswari has received number of awards and honor from different scientific organizations and delivered 18 invited lectures, 70 oral presentations. She is Life member of various scientific bodies and working as a member of editorial board and reviewer of several National and International journals. Presently, she is heading the Department of Biotechnology.

READER'S OPINION IS SOLICITED

Editor :

Prof. S.M. Singh

Department of Animal Science

Mahatma Jyotiba Phule Rohilkhand University, Bareilly-243 006, India. Call at: 09412822490, 0581-2525440

E-mail: editorvermeco@gmail.com, satyendramsingh@rediffmail.com

Published by the Secretary, SEEER, Bareilly (India). Printed by Neeraj Publishers, Bareilly