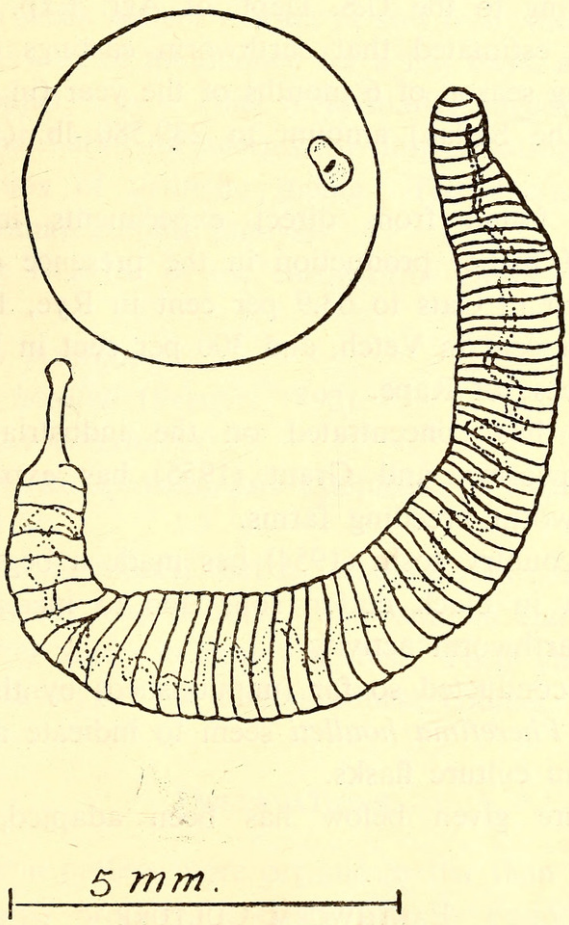
[Several notes have appeared in the *Journal* from time to time on the exceedingly varied nature of the bull frog's dietary. Reference is invited to p. 213 of Vol. **52** (1) where some of the foods previously recorded have been summarized.—EDS.]

18. A PRELIMINARY NOTE ON THE CULTURE AND DEVELOPMENT OF INDIAN EARTHWORMS

(*With a text-figure*)

The role of the earthworm is controversial. Some regard it as beneficial, whereas others consider it a pest and recommend measures for its elimination. Thus, about three years ago, the Smithsonian Institution recorded the invasion of the eastern United States by a 'Plague' *Pheretima lupeinsis* or the green earthworm.



Pheretima houlleti 24 hrs. after hatching, with capsule.

One reason for the controversy is perhaps the fact that there are many types of earthworms, some beneficial and some otherwise. Hence, the cultivation and breeding of a few selected types has been

undertaken abroad. In India, this aspect has barely received attention, though others are fairly well represented. Thus the monumental work of the late K. N. Bahl deals mainly with Systematics & Anatomy, while J. V. Bhat, N. V. Joshi, and others have concentrated on the intestinal microflora. Shrikhande & Pathak in Kanpur, and Nijhavan & Kanwar in Ludhiana have studied the physico-chemical properties of earthworm castings and the latter team has compared them to those of other insects. Such studies are of the greatest importance in India where nitrogen, in particular, is in short supply and its addition to the soil in the inorganic form is subject to losses by way of leaching, base exchange, and volatilization. The cultivation and breeding of a few select types of earthworms which may produce good manure is thus important to our agronomy.

Work along these lines has advanced so much in other countries that the following can be only a very sketchy review of the same.

Thus, according to the U.S. Dept. of Agr. Exp. Sta. Record **27**, No. 6 (2), it is estimated that earthworm castings deposited during an active growing season of 6 months of the year (in the valley of the White Nile in the Sudan) amount to 239,580 lb. (119.79 tons) per acre.

Wolney has found from direct experiments in culture boxes that the ratio of higher production in the presence of worms varied from 2.6 per cent in Oats to 63.9 per cent in Rye, 135.9 per cent in Potatoes, 140 per cent in Vetch, and 300 per cent in Field Pea to 733 per cent in the case of Rape.

Bafile (1950) has concentrated on the industrial production of humus by earthworms, and Grant (1955) has expanded upon the subject of earthworm breeding farms.

In our own country Joshi (1954) has made a beginning by noting the improvement in black cotton soils due to increased nitrification resulting from earthworm activity.

Experiments conducted so far (unpublished) by the junior author, with castings of *Pheretima houlleti* seem to indicate a fair amount of ammonification in culture flasks.

The procedure given below has been adapted, in part, from Barrett:

Earthworm Culture

Wooden boxes (11″×7″×8″) are filled with garden soil, cowdung, and straw in equal quantities (by volume) and topped up by an inch-thick layer of dried leaves. The upper surface of the leafy layer is then covered by gunny cloth. The boxes are supported on two bricks in a metal tray containing water to prevent attacks from insect

predators like red ants. A population of 250 mature earthworms can be supported by a box of this size. Accordingly they are collected and after preliminary screening, 250 healthy specimens are distributed per box. The boxes are to be watered at regular intervals, avoiding water-logging. (A two-inch layer of crocks and pebbles arranged in the bottom of the box prior to filling up provides good drainage).

The contents are examined at monthly intervals. If a few cocoons are detected then the examination is repeated every week in order to collect the full quota of cocoons. If on the other hand, many young ones are observed then the cocoons can be taken to have hatched during the interval. If allowed to remain, the cocoons will produce young worms in the course of time. If embryological studies are in view then the following method is recommended.

10-12 cocoons are distributed over layers of moist filter or blotting paper kept in the bottom of 8″ petri dishes. The sheets are moistened with a weak watery extract of soil from the earthworm box. The young worms can be maintained for a few days, at least, on a diet of moist filter paper only. This, incidentally, suggests a method for studying the food habits of worms by impregnating the filter-paper with various kinds of artificial media. The excreta can then be subjected to chromatographic analysis.

The following is a list of the earthworms cultured by the method described.[1]

1. *Pheretima posthuma.*
2. „ *houlleti* (Perrier, 1892).
3. *Pontoscolex corethurns.*
4. *Hoplochoetella khandalensis* (Stephenson, 1924).
5. *Perionynx* sp.

It may here be mentioned that *H. khandalensis* could not be maintained successfully for long periods. *P. posthuma* and *P. houlleti* were selected for further study in pure cultures. Their choice was due to their importance as types for undergraduate courses.

Observations

1. *P. posthuma* prefers more organic matter than *P. houlleti.*

2. *P. posthuma* produces cocoons after a period of four weeks from maturity, whereas *P. houlleti* requires three weeks.

3. The cocoons of *P. posthuma* are brown in colour, oval in outline, and with two projections at either end of the long axis. The

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[1]We are indebted to Dr. G. E. Gates, U.S.A., for the identification.

cocoon is deposited deep within the burrow. *P. houlleti*, on the other hand, produces cocoons which are white, round, and slightly larger than those of *P. posthuma*. They are distinct from the soil and can be easily separated.

4. The hatching period for *P. posthuma* is about 30-37 days under petri dishes, while *P. houlleti* requires 25-30 days depending on the temperature and humidity. If the temperature is lowered below 28° C. and 50% relative humidity, the cocoons take a longer time to hatch, about 45-50 days.

5. Both the worms are surface casters.

6. A newly hatched animal has same segments as the adult.

7. About 20% of the cocoons do not develop; probably they are unfertilized.

In brief, it is hoped that the technique presented here will enable workers to contribute towards elucidating the role of the earthworm in agronomy. The animal is also interesting from the zoological as well as the biochemical point of view. Regeneration, respiration, and the nitrogen content of the excreta are some other aspects of importance. Lastly, it will enable teachers to provide live specimens for dissection throughout the year.

Acknowledgements

The authors wish to thank Dr. D. V. Bal, Director, Institute of Science, and Prof. Mrs. E. Gonzalves, Prof. of Botany, Institute of Science, for the facilities provided and for their constant encouragement.

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August 8, 1959.

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