

NOTE ON LUMINESCENCE IN THE EARTHWORMS OF RANGOON.

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Professor Meggitt of University College has very kindly handed to me a report on luminescence in an earthworm made by one of his students, F. J. Nahapiet, together with the worm on which the observations were made. The worm is *Eutyphœus peguanus*, and the report is as follows:—
“The earthworm was found crawling across a macadamized road after a heavy shower of rain, one evening at about eight o'clock. Upon picking up the worm it was found that the portion held between the fingers emitted a faint, whitish phosphorescence. To obviate the possibility of foreign matter causing the phosphorescence the worm was thoroughly washed with water. The worm when rubbed exuded a whitish substance which covered the fingers causing for a few minutes a faint glow gradually fading away. The light was sufficient to show the general shape of the worm but not the segments. The breaking of the worm caused the cessation of the experiment.”

So far as it has been possible to determine from the literature at hand there is no previous record of luminescence of earthworms from India. Harvey in his Monograph on “The Nature of Animal Light” lists seven genera of Oligochæta that contain photogenic species. Of these, five, *Lumbricus*, *Allolobophora* (*Eisenia*), *Microscolex*, *Enchytraeus*, and *Octochætus*, are found in India. Only one specimen of *Microscolex* and that *M. phosphoreus* (doubtless a luminescent form) has been reported from India (at Peshawar). *Lumbricus* and *Allolobophora* are almost entirely represented here by peregrine immigrants, *Enchytraeus* is aquatic *Octochætus* is found only throughout India and New Zealand. The luminescence possibly has been reported from the New Zealand species of the genus. Our knowledge of the Indian Oligochæta is very largely based on the study of museum specimens which are not usually gathered under conditions that would make possible observations on the light producing powers of these animals.

It has not been possible in the experiments reported herewith to rely on worms found above-ground in the night. It has been necessary in order to secure an adequate supply of material of the various species to rely on worms obtained by digging. The worms secured in this way in the afternoon have been brought into the laboratory at about four or five o'clock when they have been sorted at once and placed according to species in glass jars where they have been left until eight o'clock or later. Of the twenty-two species of earthworms of Rangoon only seventeen could be secured at the season of the year when these experiments were carried on. The majority of these have no luminescent phenomena and require no further mention.

The worms left in the glass jars as previously mentioned have never been observed to emit luminous mucous although large masses of worms have been left in this way for long periods of time. Allowing the worms

to crawl on dry and wet, rough or smooth surfaces has failed to result in the production of light. Rubbing gently and shaking violently in water have also produced no positive results. In the laboratory conditions under which the present work has been conducted the luminescence has only been obtained by the more violent mechanical stimuli such as cutting, pinching, pricking, or crushing, or by chemical stimulation secured by immersion of the worm in methylated spirits, or weak solutions of various substances such as ammonium hydroxide, chloretone, etc. If a worm is dropped into methylated spirits and then quickly removed so that the ejected mucous still clings to the worm, patches of faint glow appear that may last for an hour or more. The mucous or worm in the methylated spirits never luminesces. The most satisfactory method of demonstrating the photogenic ability of the worm is to drop the animal into a finger bowl containing a very weak solution of ammonium hydroxide in water. The worm lies quietly for a moment and then commences to writhe around in a rather deliberate fashion. After a varied amount of this writhing, mucous is suddenly shot out from the dorsal pores along more or less the whole length of the body. The light is not produced immediately on the discharge of the mucous but appears only after the lapse of a short interval, the light gradually increasing until it reaches a maximum amount. As the photogenic capacity of the species vary it is desirable to discuss each one separately.

Eutyphæus peguanus.—The luminescent masses of mucous produced in the ammonia solution are varied in size, many much larger than the head of a pin. At first they are scattered throughout the water in the bowl but if the worm is removed or becomes quiet, the glowing masses slowly sink to the bottom. The light is whitish and bright enough to enable one to see clearly the features of countenance and garb of those watching the phenomena. If undisturbed the mucous masses glow for several hours. If the water is agitated violently enough by the writhing of the worm or by stirring with a rod, the luminescent substance becomes evenly distributed throughout the liquid and the amount of light given off appears to be much reduced. If the liquid is now filtered some of the luminescent substance passes the filter. The filtrate shows the so-called Tyndall effect, indicating the presence of a substance in colloid condition. This is presumably the luminescent substance as it hardly seems possible that such a substance could be in solution.

The worm is not pigmented and the internal organs show clearly through the transparent body wall. At no time during the course of the experiments has any luminescence been noted within the body of the worm of this or any other species.

Eutyphæus foveatus.—Worms of this species writhe around in the finger bowls of ammonia solution much longer before discharging the mucous than the preceding species. The amount of light produced by a single mature worm is much less than that produced by the preceding worm although the two are about the same size. The luminous masses of mucous are about the same as in *E. peguanus*. But the number of glowing masses produced is usually smaller.

This worm is heavily pigmented, having a deep rich brown colour dorsally and laterally.

Eutyphæus rarus.—This worm is extremely rare in Rangoon, and it has been possible to obtain only four specimens for use in these experiments. One failed to give any visible luminescence at all when stimulated mechanically by pricking, cutting, and crushing. The other three were treated with the ammonia solution. Of these two gave positive results. In both of these worms the luminescence was confined to two small masses of mucous which glowed less than five minutes each. At the end of that period the light had entirely disappeared.

This, like the preceding worm, has a deep brown colour dorsally and laterally. It is slightly smaller than both the other species.

Only these three species of the genus *Eutyphæus* are to be found in Rangoon and all of them are able to produce, under certain conditions, varying amounts of luminescence. As this phenomenon has been reported from the related genus *Octochætus* numerous efforts have been made to obtain the glow in the mucous of *O. birmanicus*, the only species of this genus which occurs in Rangoon. None of these attempts have succeeded. The only other Rangoon worm with photogenic ability belongs to a quite different genus.

Megascolex mauritii.—A single specimen of this worm when dropped into the ammonia solution ejects after considerable writhing fine mucous masses which glow faintly for a short time only, usually less than five minutes. The amount of light produced by one of these worms is very small and visible only in absolute darkness. A bowl containing a single specimen of *E. peguanus* or *E. foveatus* in the near vicinity is bright enough to prevent the light being seen. If some thirty or forty of these worms are dropped together into a bowl, light equivalent, roughly speaking, to that produced by one *E. peguanus* is liberated, and the mucous masses thus formed glow for several hours.

This worm like *E. peguanus* is unpigmented, with transparent body wall, and like *O. birmanicus* is the only species of the genus which occurs in Rangoon.

SUMMARY.

Four species of the earthworms which occur in Rangoon, three belonging to the genus *Eutyphæus*, and one to the genus *Megascolex*, eject from the dorsal pores, after certain mechanical and chemical stimulation, a mucoid substance which luminesces in various degrees according to the species of the worm producing it. This phenomenon has not been reported hitherto from either of these two genera, and is possibly the first report of light-producing ability to be made on Indian earthworms. There seems to be no correlation between photogenic ability and pigmentation. The luminescence appears in the mucous only after a definite interval has elapsed from the time of ejection of the mucous.

REFERENCE.

Harvey, E. N. 1920. *The Nature of Animal Light.* Monographs on Experimental Biology. Philadelphia.