



Phototactic Response in Earthworm – “*Eisenia foetida*”

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ABSTRACT

It is proved that the reactions which are typical of the life in the burrow are more definite and controlled by weaker stimuli than reaction in the open, and this may be expressed by saying that the earthworm's organization is more highly adapted for life in the burrow. Reactions in the axial direction are definite and sensitive to stimuli than lateral movements in response to light.

Keywords: Earthworm, Light, Movement, Phototropism

INTRODUCTION

This paper aims to show that random movements are a feature of less strong light, tending to disappear with the increase of intensity, and are replaced by direct orientation in very strong light. It is also shown experimentally that the earthworms are more sensitive in the extended than in the contracted state, and that this has an important bearing upon the production of random movements. The explanation given of this is that when extended the sensitive elements of the skin are expanded over the greater surface.

Locomotion consists of a succession of extensions and contractions and as each extension begins in a state of lower sensibility the anterior end may be projected toward the light, only to be checked when its increase of sensibility with extension makes the stimulus appreciated. Movements away from the light are not so checked. In stronger light the sensibility of the worm when contracted is sufficient to suppress movements toward the light at the outset in such light

the worm appears to be orientated without trial movements.

THEROY OF TROPISMS:

The orientations to light and other stimuli, which are among the most striking phenomena in the behavior of the lower animals, have received various explanations. After the first anthropomorphic explanations of these movements, based upon likes and dislikes, there came an apparent revolution of ideas bringing in explanations of seemingly great simplicity. As the physiology of plants, particularly of the higher plants, had made considerable progress towards a solid physico-chemical basis, there was transference of conceptions based upon plant physiology to the realm of animal behavior and the orientations of the lower animals were illuminated by analogies drawn from plants. The mechanism of the tropism was not a reflex according to this conception, but was a unique form of movement to be added to the classification of animal movements into reflex, instinctive and voluntary.

The current theory of phototropic or tactic phenomena as applied, for example, to the earthworm, was that when light strikes one side of the animal so as to cause unequal stimulation of the two sides, it changes the tone of the muscles on the side effected. The muscle of one side are thus either relaxed or their tension is increased as the animal happens to be positively or negatively phototropic. It is bent away from or toward the source of stimulation by the direct action of the environment upon the protoplasm.

DESCRIPTION OF THE SPECIES:

Eisenia foetida commonly known as *red worm* or *brandling worm* is a species of earthworm adapted to decaying organic material. These worms thrive in rotting vegetation, compost, and manure. They have groups of bristles (called setae) on each segment that move in and out to grip nearby surfaces as the worms stretch and contract their muscles to push themselves forward or backward.

The worms are of rather large size, they are found often measuring 9 inches in length when killed fully extended they are rather pointed at both ends. The continuous circles setae on each segment give the name to the family. The clitellum is a complete band or girdle encircling segments 14-16.

Earthworms do not have eyes like we do. Instead they can sense light through their skin. These are natural light sensors. Earthworms try to stay out of light because the heat from the bright light dries out their skin. If an earthworm skin becomes too dry it would not be able to breathe and it would die. The blue light is more like a cloudy day to the earthworms. It is not as bright as the red light and therefore does not scare the earthworm like the regular bulb.

REACTIONS OF EARTHWORMS TO LIGHT:

Since Darwin's account of the habits of earthworms there has been a series of papers devoted chiefly to the directive action of light upon these forms. Parker and Arkin, Miss. Smith, Adams and Holmes has studied the reaction of earthworms crawling over surface, exposing to light stimulation from one side.

They regarded the various head movements in different directions as due to a variety of chiefly undefined causes in addition to light and since 4% were towards the light they assume that as many of the negative responses would be due to other causes than light. Movements that are towards the light are checked and the animal draws back and usually moved in the opposite direction straight ahead.

Materials & Methods:

A wooden box with a partition creating two smaller chambers, moist mud, Live Earthworms, Grain/Pulse pest, Bulb fixed in one of the chambers of the box.

The partitioned wooden box has two sides A and B, fix a small dim bulb in side A, spread moist mud in

both sides, leave equal number of Earthworms in both chambers.

The partitioned wooden box with two sides A and B has taken. Moist mud was spread on both sides and equal number around 20 Earthworms in both the chamber was taken for the Experiment. The partition was provided with small gateways for Earthworms to move from one side to another. Light the bulb and the box was closed and the experiment is left for 24 hours.

Next day the box was opened and number of Earthworms was counted in each chamber.

RESULTS:

It was observed that more number of Earthworms was on the dark side of the chamber. Hence, they are photonegative.

The same experiment was repeated by changing the colour, Intensity and Temperature of the bulb

Situation -1: The bulb is dim and cold

Number of Earthworms in chamber : A = 12

Number of Earthworms in chamber : B = 8

Situation -2: The bulb is little bright and warm:

Number of Earthworms in chamber : A = 8

Number of Earthworms in chamber : B = 12

Situation -3: The bulb is bright and little hot

Number of Earthworms in chamber : A = 5

Number of Earthworms in chamber : B = 15

Situation -4: The bulbs are red and blue in two chambers:

Number of Earthworms in chamber: A = 18

Number of Earthworms in chamber: B = 2

INTERPRETATION:

It was observed that in all the situations the number of Earthworms in dark chamber i.e., Chamber B was more when compared to light chamber. Hence, Earthworms are photonegative.

The intensity of the light was also seen by changing the colour of the bulb. It was observed the Earthworm prefer the cool and dull blue light when compared to bright red

light. This situation also proves that they are photonegative in nature.



Fig-A- Experimental Setup Fig-B- Experiment showing Fig-C- Showing dim & bright light
with blue light

CONCLUSION:

It may be well for clearness to suppose a study. This would give rise to an excess of negative movements in any large number that were counted. Holmes says that the excess of negative movements may be due to one of three causes – accident, failure to count many of the slight positive movements which are easily overlooked, or to a slight orienting tendency of the light. Holmes undoubtedly has in mind first movements only,

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