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A Study on life cycle of Earth worm *Eudrilus eugeniae*

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Abstract

Eudrilus eugeniae is an earthworm species indigenous in Africa but it has been bred extensively in the USA, Canada, Europe and Asia for the fish bait market, where it is commonly called the African night crawler. In the present study the *Eudrilus eugeniae* were grown in cow dung and their life cycle were studied in different days of intervals like 15, 30, 45 and 60 days. The important parameters such as cocoon production, hatchlings, total biomass and length of the earthworms were measured. The cocoon production was started at after 30 days and hatchlings were released after 45 days.

Key words: *Eudrilus eugeniae*, Life cycle, Cow dung.

Introduction

Eudrilus eugeniae has originated from West Africa and are popularly called as "African night crawler". They are also found in Srilanka and in the Western Ghats of India, particularly, in Travancore and Poona (Graff, 1981). *Eudrilus eugeniae* lives on the surface layer (epigeic) of moist soil and are also found wherever organic matter is accumulated (Bouche, 1977). It is nocturnal and lies in the surface layer during the day. The worm is reddish brown with convex dorsal surface and pale white, flattened ventral side. The clitellum is paler than the rest of the body. The adult worms are about 25-30 cm in length, 5-7 mm indiameter, consist of about 250-300 segments and weigh 5600 mg of maximum individual biomass (Viljoen and Reinecke, 1994). The rate of growth in oligochaetes is relatively proportional to nutritional level. Age of the worm, organic matter content, moisture (65-75%) and temperature (28-34°C) are other factors influencing the growth rate of worms (Lavelle,1983).According to Viljoen and Reinecke (1989 and 1994) the first indication of clitellum development appeared between 35-45 days; worms with fully developed clitellum copulated readily.The formation of cocoon started within 24 hours after copulation and continued up to ±300 days in *Eudrilus eugeniae*(Viljoen and Reinecke, 1989).

The cocoons of *Eudrilus eugeniae* have an irregular oval shape and are sharply pointed with fibrous tips at the two ends. The cocoons are soft and grayish-white in colour immediately after formation, but harden rapidly with the colour changing to orange brown. Finally, the cocoons become dark-brown in colour immediately before hatching. The mean length of the cocoon is 6.02mm (range 4.3-7.8 mm), diameter between 2.1-4.0mm and mean mass of 16.99mg (Reinecke and Viljoen, 1988). A mean production of 1.3 cocoons/worm/day was observed by Viljoen and Reinecke (1994). Incubation period of *Eudrilus eugeniae* cocoon was 16.6 days at 25°C in cattle manure with a hatching success of 84% and 2.5 mean number of hatchlings per viable cocoon. (Reinecke and Viljoen, 1988). Upon emergence, the hatchlings have a pink yellowish to red colour, with the hinder most segments still not fully differentiated.

The studies on growth, reproduction and life cycle of the wide spread Indian megascolicid worm, *Lampito mauritii* one among the four endemic species are very scanty. It can withstand wide range of temperature, soil moisture and various other physical factors (Kale, 1988) and with wide choice of habitats and food preferences it has the highest frequency of distribution (Kale and Bano, 1992). Only cocoon morphology, hatching and emergence pattern in this worm have been studied by Bhattacharjee and Chaudhuri (2002). A thorough understanding of the reproductive biology and growth of a worm is a pre-requisite before subjecting the worm to any experimentation in the laboratory

and more particularly in the agro-industrial practices. Over 10,000 species of earthworms exist around the world and only 31 described species of earthworms inhabit Thailand (Gates, 1939). The culture of worms on a large scale is in high demand for the production of both protein and biofertilizer. In every region of the world, many species of earthworm are cultured namely *Eisenia fetida*, *Lumbricus terrestris*, *Perionyx excavatus* and *Eudrilus eugeniae* in all part of the world. In Thailand, these four economically important species of earthworm are of great importance in the vermicomposting of a wide variety of organic wastes and also a potential source of protein for animal consumption *Eudrilus eugeniae* is widely distributed in warmer parts of the world and cultured as the "African Nightcrawler"(AF). Introduced species are commonly found over a large area of tropical Asia, namely, the blue worm or Indian worm (*Perionyx excavates*), red worm (*Pheretima peguana*) and earthworm from Lao (*P. excavates*) as previously described by Ayamuang(2000). However, the AF earthworm (*E. eugeniae*) and red worm (*P. peguana*) are almost similar in body size and coloration.

Reproduction by cross fertilization in majority of the species of earthworms but parthenogenesis also occurs in few. During copulation two worms come together in opposite directions, with the ventral surface attached to each other in such a way that the spermathecal openings touch each other. The seminal grooves carry the seminal fluid from the male pores to the clitellar region and enter the spermathecae of the partner worms. In general like *Eisenia*, *Lumbricus*, *Dendrobaena*, *Dedeodrilus*, *Aporrectodea*, *Octalasion* sperms are transferred through spermatophore. After copulation the clitellum produces cocoon. The cocoon contains ova, aluminous fluid and spermatozoa. The cocoon morphology varies among the different species of earthworms; it is spherical, lemon shaped or oblong with pointed tips. They may be white, yellow or brown, the color changes from yellow to brown during the incubation time. Immediately after laying they are white or yellow and gradually turn into brown as development proceeds. The rate of hatching varies between species (Stephenson,1930).

In recent times, morphological characters still are used to characterize earthworm species. Stephenson (1930) reported that the genital system is much more conservative and resistant to evolutionary change than the somatic system. Population dynamics, productivity and energy flow in earthworms cannot be fully understood unless the life cycle of the earthworm is known. Studies on the life cycles of earthworms are also necessary for effective vermiculture. Hence the present study is aimed to study the life cycle pattern of the earthworm *Eudrilus eugeniae* using cow dung as a substrate.

Materials and Method

Collection of cowdung

The cow dung was collected from the Faculty of agriculture and animal husbandry Gandhigram Rural Institute-Deemed University, Gandhigram, Tamilnadu, India. The cow dung was separated from the soil and subjected to pre decomposition for 10 days in plastic trays by sprinkling water.

Collection of earth worms

Then the mature clitellate earth worms *Eudrilus eugeniae* were collected from S.S earthworm form, Pandiyarajapuram near vadipatti, Madurai district, Tamilnadu, India.

Experimental set up

The mature earthworms were introduced in the trays contain pre decomposed cow dung the moisture content was maintained between 50-70% throughout the study by sprinkling adequate quantities of water. During the experiment the aeration was given twice in a week.

Observation of growth rate of *Eudrilus eugeniae*

In the growth rate such as number of earthworms cocoon production and weight of earth worms were observed.

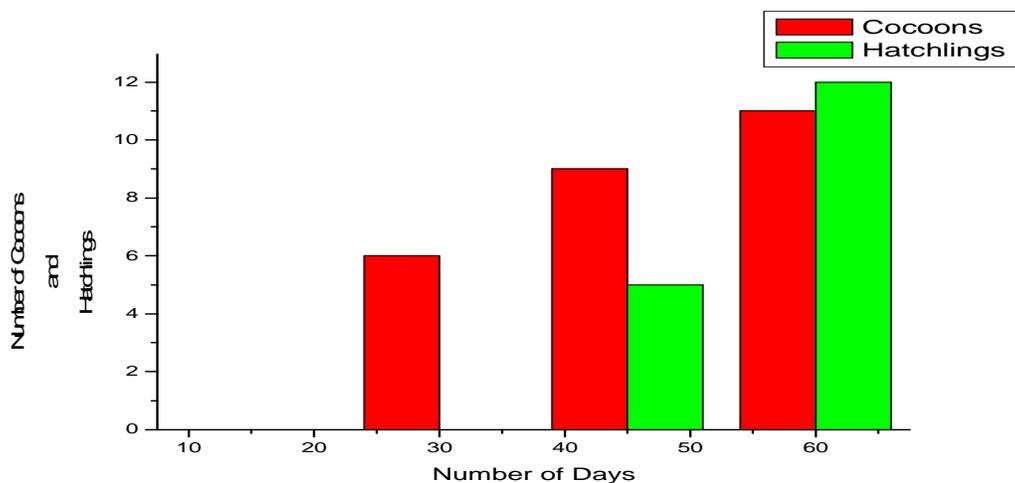
Results and Discussion

Growth (length and biomass) reproduction (cocoon and hatchling production) of *Eudrilus eugeniae* cultured in cow dungs at different time intervals like 15,30 45 and 60 days are represented in Figures 1 and Table 1.

Table 1: Total Biomass and Length of worms in different day intervals

Parameters	Number of Days				
	0 Days	15 Days	30 Days	45 Days	60 Days
Total Biomass (mg)	15± 0.08	18.1± 0.19	22.2± 0.14	23.8± 1.04	24.4± 0.52
Length of adult worms (cm)	0.32± 0.21	6.58± 0.14	8.61± 0.23	14.83± 0.28	18.35± 0.26

*Values are represented as Mean ± Standard Deviation

Figure 1: Number of Cocoons and Hatchlings production in different days of intervals

The length of earth worms were measured in regular intervals and at the day of hatchling it is about 0.32 ± 0.21 cm and it will reach maximum after 60 days for about 18.35 ± 0.26 . The figure 2 shows the cocoons of *Eudrilus eugeniae* it is very small and it gives one to two hatchlings after 45 days.

Figure.2: Different stages in life cycle of *Eudrilus eugeniae*

Discussion

Eudrilus eugeniae increased in total biomass much more rapidly than *Eisenia fetida*, a species which grows relatively well in most organic wastes. Moreover, *Eudrilus eugeniae* reached sexual maturity in as little as five weeks compared with *Eisenia fetida* which took 6-8 weeks to produce its first cocoon (Edwards, 1988). This is a more rapid development than for any species of earth worm that has been reported to date and such growth rates make a very fast rate of population multiplication possible. The maximum weight gain of *Eudrilus eugeniae* was 280mg per week, compared with others. Reinecke *et al.*, (1992) reported a maximum weight gain for *Eudrilus eugeniae* of 150 mg per week, at 25°C, significantly less than that of our result.

The maximum rate of cocoon production by *Eudrilus eugeniae* was 3.6 cocoons per week at 25°C. This is a similar rate to that of *Eisenia fetida*, which has been reported to produce 3.8 cocoons per week, but *Eisenia fetida* reproduced most rapidly at 20°C Edwards (1988). The maximum rate of cocoon production in our study was much faster than the 0.7 cocoons per week that were reported for *Eudrilus eugeniae* by Neuhauser *et al* (1979), but less than for *Perionyx excavatus* which has been reported to produce up to 19.5 cocoons per week (Edwards *et al.*, 1988). The percentage earthworm hatchlings of 81% at 25°C was high, and although the number of hatchlings per cocoons (more than two) was comparatively low, the 6.5 hatchlings produced per week at 25°C compared well with the Productive by *Eisenia fetida* of 10.4 cocoons per week at 20°C and *P.excavatus* of 5.2 cocoons per week at 20°C (Edwards *et al.*, 1998). The hatchling success of *Eudrilus eugeniae* that we found was very similar to that of the

78% reported by Reinecke *et al* (1992) who observed that the number of hatchlings per cocoon was usually more than two. Neuhauser *et al.*, (1988) also reported that *Eudrilus eugeniae* produced two live earthworms per cocoon.

The shortest time from producing cocoons to sexual maturity, for *Eudrilus eugeniae* was 47 ± 3 days. The time from hatching to sexual maturity was 35 ± 3 days, which agrees with the results of Reinecke *et al.*, (1992) who reported that *Eudrilus eugeniae* started producing cocoons after 46 days. Earthworm survival was excellent, with little mortality occurring at temperatures other than 30°C. This agrees with the results of Reinecke *et al.*, (1992), but contrasts with the data of Neuhauser *et al.*, (1979) who suggested that few individuals survived longer than 12 weeks, regardless of population density. All the evidence from our larger scale cultures is that *Eudrilus eugeniae* is a long-lived earthworm.

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