Comparative Study Of Growth And Reproduction Of Earthworm Eudrius Eugiene And Eisenia Foetida Cultured In Cowdung And Bombax Ceiba Leaf Litter

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Abstract:
The vermin shed were prepared in plastic container containing Cowdung+ earthworm (T1), Cowdung + Leaf Litter (T2), Cowdung + Leaf Litter+ earthworm (T3). At intervals of 15, 30, 45, 60, 75, and 90 days, we examined the biomass and cocoon generation in earthworms in each experimental container. Earthworms and cocoons, generated throughout the studies, were manually sorted from the substrate material. Data about biomass, cocoon counts, and several growth characteristics of the offspring, such as growth rate, maximum weight attained, and reproduction rate were gathered and documented under the different experimental conditions.

Keywords: Earthworm, Vermicompost, *Eisenia Foetida*, *Eudrilus Eugiene*, Biomass, Cocoon

Introduction:
Degradation of the environment is a significant problem that the world is currently facing, and the widespread application of chemical fertilizers is a key contributor to the deterioration of the environment. (Wani and Lee 1992, Wani et al. 1995). On the one hand, tropical soils are low in all of the essential plant nutrients, while on the other hand, enormous quantities of these nutrients that are present in household wastes and agricultural outputs are thrown away. (Bhiday 1994).
Vermicomposting is a biological process that involves the decomposition of organic wastes in which earthworms interact closely with microorganisms and other soil organisms in the decomposer community. This interaction has a significant impact on decomposition processes, speeding up the breakdown of organic matter and causing significant changes in its physical and biochemical characteristics (Domı´nguez 2004). This process creates organic manure, which can be used for agricultural purposes.
Vermicompost enhance soil fertility by introducing plant growth hormones and increasing levels of soil enzymes. Additionally, they play a crucial role in spreading essential microbes due to their high microbial diversity, population, and activity (Gopal M. et.al, 2009).
Generally speaking, epigeic and endogeic species of earthworms are utilized extensively for the aim of vemicomposting various types of organic waste. Furthermore, it has been discovered that epigeic species are not only quick to reproduce but also efficient feeders on wastes that are rich in organic materials. The epigeic earthworms Eudrilus eugeniae were optimally utilized for the decomposition of organic matter, resulting in the production of manure. As a result, they are suitable for vermicomposting and can be utilized with great success. (Kale and Bano 1998)
The Eudrilus eugeniae worm is about 20-25 cm in length 5-7 mm in diameter and weighs around 5-6 g. The clitellum makes its appearance by about 24-30 days and becomes fully developed copulation takes place during night by about 30-32 days. Cocoons are laid a day after copulation. The cocoons are oval in shape, pointed at both ends. It is about 6.00 mm in length, 3 mm wide and weighs about 16.0 mg a mean production of1.3 cocoons/worm/day was reported by Viljoen and 80% hatchling success and 2.6 mean number of hatchling per viable cocoon. (Umamaheswari.P et. al. 2023)
The Sustainable Agriculture Research and Educational Program at the University of California describes *E. fetida* as having a red, cylindrical body with red color; 35 – 130 x 3 – 5 mm. *E. fetida* can live a maximum of 4 – 5 years, and can reproduce sexually, producing up to about 900 eggs (cocoons) per worm per year. Each cocoon or worm egg can have 2 to 20 worms (Urban Agriculture Notes, Published by City Farmer, Canada's Office of Urban Agriculture). Each worm weighs between 0.2 to 0.3 gm.

The number of its segment is about 80-110 and it's between 23-130 mm length. During puberty, the genital belt reaches to 7-9 pieces in between parts 24, 25 or 26 or 32. Adult worms weight is approximately 1.5g and about 50 to 55 days after coming out of the cocoon they are able to reproduce. Adult worms can create a cocoon every three days on average that after 23 days one- third of newborns come out of the cocoon. (**Roghaye Fadaee, 2012).**

Materials and Methods

Bombax ceiba (Family-Bombacaceae) leaf litter is selected for the production of biofertilizer through vermicomposting. The leaf litter was collected from our college campus shade dried and used as organic waste. Urine free fresh cow manure (cow dung) was collected from Gaousala, Suratgarh.

Young non-clitellate specimens of *Eisenia fodtida* and *Eudrilus eugiene*, weighing 200-300 mg live weight were randomly picked from several stock cultures containing 500-2000 earthworm in each, maintained in the laboratory with cow dung as culturing materials.

Experimental Design for Vermicomposting

The experiments were performed in small plastic containers (diameter 15 cm, depth 12 cm.) with small drain holes drilled at bottom. The waste material (Leaf Litter) used in this experiment was dried at 60 ºC and chopped in minor parts. To prepare the bedding, leaf litter was weighted for 50 grams for each container and mix with 50 gram of amendment material i.e. cow dung and covered the bed by jute pockets. The mixture of leaflitter and cow ding in container served as bedding and feed for worms. The vermin shed were prepared in plastic container containing Cowdung+ earthworm (T1), Cowdung + Leaf Litter (T2), Cowdung + Leaf Litter+ earthworm (T3). All bedding was kept for two weeks prior to the experimentation for thermal stabilization, initiation of microbial degradation and softening of waste. The wastes were turned over manually every day for 15 days in order to eliminate volatile toxic gases. The moisture content of wastes was adjusted to 70-80 % during study by spraying adequate quantities of distilled water. A total of 10 of earthworms were placed into each of the container. All containers were kept in a humid and dark room at temperature 25±1ºC. The freshly formed vermicompost from all the experimental plastic containers were collected after 0, 15, 30, 45, 60, 75 and 90th day and air dried, weighed, sieved and store in polythene bags for Chemical analysis and impact study.

At intervals of 15, 30, 45, 60, 75, and 90 days, we examined the biomass and cocoon generation in earthworms in each experimental container. Earthworms and cocoons, generated throughout the studies, were manually sorted from the substrate material. The worms were then rinsed in tap water to eliminate any debris clinging to their bodies, and subsequently weighed. The weight was measured and the earthworms were placed back into their respective containers. The individual cocoons were numbered and placed in separate bedding that contained the same material as the one their parents used for rearing. Data about biomass, cocoon counts, and several growth characteristics of the offspring, such as growth rate (measured in milligrams per day), maximum weight attained, and reproduction rate (measured in cocoons per worm per day), were gathered and documented under the different experimental conditions.

Result and Discussion

Vermicomposting converts a portion of the organic matter into worm biomass and respiration products and excrete some of the ingested on as partially stabilized products, i.e. vermicompost. Vermicomposting is also considered in terms of production patterns of earthworm biomass and no. of cocoon.

The mean individual and the total biomass gain, reproduction rate, total cocoon morphology rate in the present study varied across different treatments. The worms when introduced into wastes show an increased growth and reproduction activities.

Biomass

The growth curves of *E. Foetida and eudrilus eugiene* in studies leaf litter experiments over the observation period are given in Fig 1

The increase in body weight of all two earthworm's species was noted in all the experiments, which could be because of substrate quality or could be correlated to fluctuating environment conditions.

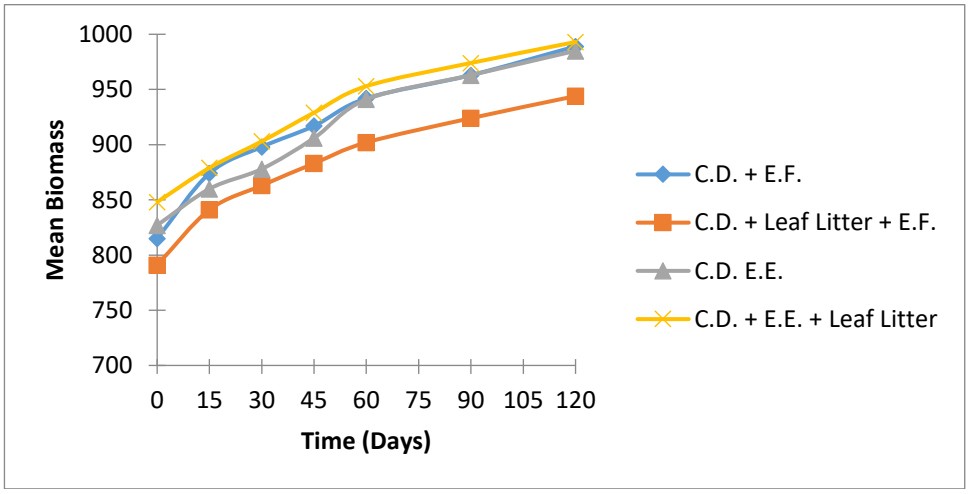

Fig 1 Growth curves of *E. Foetida and eudrilus eugiene*

Time		Cow Dung + E.Foetida		Cow Dung + Leaf Litter + E.Foetida		Cow Dung + E.Eugiene		Cow Dung + Leaf Litter + E.Eugiene	
		Test	Mean	Test	Mean	Test	Mean	Test	Mean
0	R1	835	815	771	791	848	827	827	848
	R2	814		812		798		868	
	R3	796		791		836		849	
15	R1	895	874	822	841	875	860	860	879
	R2	872		856		838		896	
	R3	855		846		866		880	
30	R1	915	898	846	863	889	878	891	903
	R2	904		882		864		912	
	R3	875		862		880		905	
45	R1	930	917	864	883	914	906	923	929
	R2	920		898		898		938	
	R3	901		886		906		926	
60	R1	957	942	888	902	943	941	950	953
	R2	939		917		939		963	
	R3	930		901		941		947	
90	R1	975	963	915	924	965	963	971	974
	R2	961		932		961		980	
	R3	953		926		963		970	
120	R1	996	989	934	944	982	985	992	993
	R2	989		951		979		998	
	R3	982		948		994		989	

Table 1: Bio mass of the earthworms employed on vermicompost production

Rate of production of Cocoon and fecundity

The cocoon production pattern of all the two studied species in bedding materials have been illustrated in Fig 2

Table 2 summaries the sexual development and cocoon production by E. Foetida and E. Eugiene in different feeds. Cocoon production by earthworms was started by sixth week.

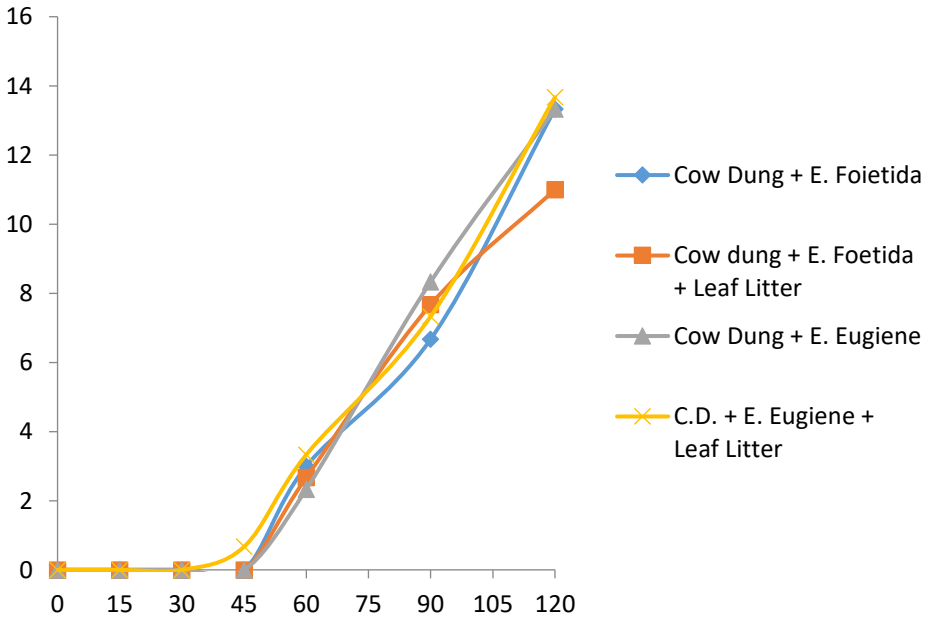

Fig 2 cocoon production pattern

Time		Cow Dung + E.Foetida		Cow Dung + Leaf Litter + E.Foetida		Cow Dung + E.Eugiene		Cow Dung + Leaf Litter + E.Eugiene	
		No.	Mean	Test	Mean	Test	Mean	Test	Mean
0	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
15	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
30	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
45	R1	0	0	0	0	0	0	1	.67
	R2	0		0		0		1	
	R3	0		0		0		0	
60	R1	2	3	1	2.67	2	2.33	3	3.33
	R2	4		3		2		4	
	R3	3		4		3		3	
90	R1	6	6.67	5	7.67	6	8.33	6	7.33
	R2	7		8		9		9	
	R3	7		10		10		7	
120	R1	12	13.33	8	11	11	13.33	11	13.67
	R2	14		11		14		16	
	R3	14		14		15		14	

Table 2 : cocoon production pattern

Cocoon hatchling experiments

Both earthworms showed the different patterns of cocoon hatchlings.

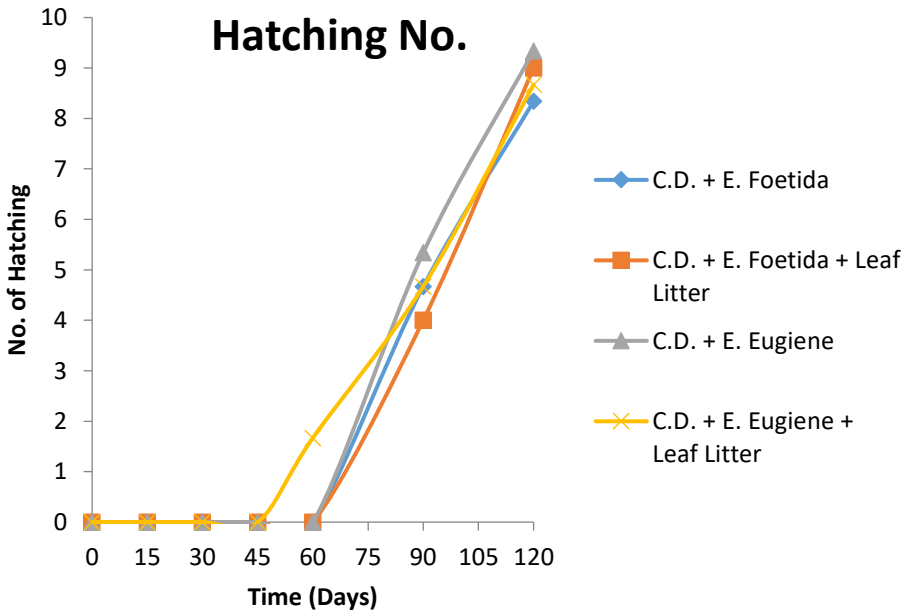

Fig 3 : Hatching No

Time		Cow Dung + E.Foetida		Cow Dung + Leaf Litter + E.Foetida		Cow Dung + E.Eugiene		Cow Dung + Leaf Litter + E.Eugiene	
		No.	Mean	Test	Mean	Test	Mean	Test	Mean
0	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
15	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
30	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
45	R1	0	0	0	0	0	0	0	0
	R2	0		0		0		0	
	R3	0		0		0		0	
60	R1	0	0	0	0	0	0	2	1.67
	R2	0		0		0		2	
	R3	0		0		0		1	
90	R1	4	4.67	4	4	5	5.33	5	4.67
	R2	4		6		6		6	
	R3	6		2		5		3	
120	R1	7	8.34	8	9	9	9.34	9	8.67
	R2	8		11		9		10	
	R3	10		8		10		7	

Table 3: Hatching No

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