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Reproductive Potential of Vermicomposting Earthworms, *Eudrilus eugeniae* (Kinberg) and *Perionyx excavatus* (Perrier) as Influenced by Seasonal Factors

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Abstract : Studies on comparative reproductive biology of vermicomposting earthworms were taken up at the Main Agricultural Research Station, UAS, Dharwad during 2004-05, to assess the reproductive potential, across the seasons. Eudrilus eugeniae (Kinberg) was observed to have mean fecundity of 6.75 cocoons/week (with a range of 5.4 during summer months to 7.75 during rainy season) as against 2.63 cocoons/week (2.10 during summer to 3.00 in rainy months) seen in *Perionyx excavatus* (Perrier). The incubation period was 16.2 days in *E. eugeniae* as compared to slightly higher duration (20.7 days) in *P. excavatus*. Number of neonates per cocoon was higher (2.71) in *E. eugeniae*, where as it was 0.81 in *P. excavatus*. Seasonal variation appeared to exert no influence on incubation period as well as neonate numbers /cocoon, for both the species. While fecundity was reduced in summer. Hatching percentage which speaks on the viability of cocoons was higher (85.3) in *E. eugeniae* V/s 68.3 observed in *P. excavatus*, which in both the worms was influenced by seasonal changes. The results obtained in the study indicated that *E. eugeniae* is the prolific breeder as compared to *P. excavatus*.

Key words: Reproduction, vermicomposting, *Eudrilus, Perionyx*

Introduction

Earthworms are the most important soil dwelling organisms involved in the process of soil formation and organic matter decomposition. *Eudrilus* eugeniae (Kinberg) and *Perionyx excavatus* (Perrier) are the commonly used earthworms for vermicomposting in tropical and sub-tropical countries (Kale *et al.,* 1982, Reinecke *et al.,* 1992, Edwards, 1998, and Giraddi *et al.,* 2002).

There is information on the bology of vermicomposting earthworms such as *E. eugeniae*, *Eisenia fetida* (Savigny) and *P. excavatus* (Bano and Kale, 1988, Venter and Reinecke, 1988, Hallatt *et al.,* 1990, Sunitha, 1995, Manna *et al.,* 1997). However, information on reproductive biology of vermicomposting earthworms in relation to seasonal variations is lacking. In addition, there is absolutely no information on this aspect from Northern Karnataka which in recent years has made a big dent on commercial vermicompositing. With this in mind, studies were taken up to assess the reproductive potential of two key vermicomposting earthworms. This information in the present context of organic farming, has impact on management of organic wastes, with reference to selection of the worm species for vermicomposting.

Material and Methods

The study was conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during the period July 2004 to May 2005.

To study incubation period, number of young ones per cocoon and hatching percentage, freshly laid cocoons of *E. eugeniae* and *P. excavatus* were collected, washed lightly in distilled water and randomly divided into ten batches of 10 cocoons each and kept for incubation. The media used for incubation was layers of moist Whatmans filter paper. The cocoons were observed every twenty four hours for the incubation period and at the end of the study in each season, hatching percentage was worked out. The number of neonates emerged from each batch of cocoons was observed and mean number of neonates per cocoon was recorded.

Similarly, in a separate study fecundity was studied by introducing freshly matured clitellate worms in 36 x 20 x 30 cm sized plastic troughs @ a pair of worms per trough for 10 replicates. The worms were provided with food substrate of pre-composted organic matter comprising of cow dung and soybean crop waste in 50:50 proportion maintained at 70% $\pm$ 5 bed moisture. Observations were made for a period of 90 days at weekly intervals to see the cocoon laying. The cocoons laid each week in treatment troughs were collected, counted and kept separately to workout total fecundity, for each species.

During the study periods of summer, rainy and winter months, weather parameters that normally have influence on the development and biology, were recorded. The data were subjected to statistical analysis after suitable transformations wherever necessary.

Results and Discussion

The results pertaining to various parameters of reproductive biology of two earthworm species are presented in Table 1 and 2, while weather parameters are given in Table 3.
Fecundity : The cocoon laying ability (Fecundity) of *E.*

eugeniae ranged from 7.75/week/pair of worms during rainy season to a significantly lower 5.40 in summer period. But there was no significant variation in the fecundity levels observed during rainy and winter months (7.10). *P. excavatus*, the other vermicomposting earthworm was observed to lay fewer number of cocoons as compared to *E. eugeniae*, which varied from a significantly higher fecundity during rainy (3.00) and winter months (2.90) to a lower rate of 2.10 cocoons/pair of worms in summer. It appears that moderate temperature ranges (21 to 24^{0}C) present during rainy and winter months exert positive influence on the ability of the worms to lay greater number of cocoons at a fairly high RH levels of 75 to 83% (specially during July to October period). It decreased substantially with steep decline in RH level to 43 to 56% and a gradual increase in temperature from 21 to 29^{0}C (Table 3). Such influence of environmental factors specially temperature on the fecundity of vermicomposting earthworms are on record (Reinecke and Kriel, 1980, Reinecke and Venter, 1987 and Giraddi, 2000).

Incubation period : Incubation period which was slightly longer in *P. excavatus* varied from 20 to 21.7 days, but in *E. eugeniae* it ranged from 15.3 to 16.8 days. Variation observed in the incubation period of two species between study periods was found non-significant.

Hatching percentage and number of neonates/cocoon

Hatching potential of cocoons that indicate the cocoon viability, was in general higher (74.5 to 91.5%). Hatching percentage in both the species was significantly higher in rainy and winter months, characterized by lower temperature (20 to 24º C)and higher RH(75 to 83%) V/s low hatching rates in summer months with higher temperatures (27 to 30ºC) and lower RH levels (43 to 56%). *E. eugeniae* recorded three times higher number of neonates/cocoon V/s *P. excavatus* and the differences observed between seasons for both the worms was non-significant. Besides, effect of weather parameters such as profound influence of temperature on growth and development of worms (Reinecke *et al.,* 1992) age of the worm (Hallatt *et al.,* 1990) bed moisture and types of food substrate (Venter and Reinecke, 1988) also determine hatching success. To quantify the effects of several environmental factors precisely, studies in the controlled environmental chambers with well defined intrinsic parameters and food substrates are desired. To conclude the present study it could be inferred that *E. eugeniae* exhibited better reproductive traits than *P. excavatus* and environment appeared to exert influence on reproductive potential and development of the earthworm species.

Table 1 : Reproductive biology of *Eudrilus eugeniae* in relation to seasonal changes

Sl. No.	Period of study	Fecundity (cocoons/ week/pair)	Incubation period (days)	Hatching percentage	No. of neonates/ 10 cocoons
1	July to September (rainy season)	7.75 (2.87)^{a}*	15.3^{a}	91.5 (73.01)^{a}**	28.8^{a}
2.	October to January (winter)	7.10 (2.75)^{a}	16.8^{a}	90.0 (71.5)^{a}	26.0^{a}
3.	February to May (Summer)	5.40 (2.42)^{b}	16.5^{a}	74.5 (59.7)^{b}	26.5^{a}
Mean		6.75	16.2	85.3	27.1
SE m±		0.105	0.215	1.76	0.245
CD at 1%		0.30	NS	5.25	NS

** - Arcsine values * - $\sqrt{x+0.5}$ values

Table 2 : Reproductive biology of *Perionyx excavatus* in relation to seasonal changes

Sl. No.	Period of study	Fecundity (cocoons/ week/pair)	Incubation period (days)	Hatching percentage	No. of neonates/ 10 cocoons
1	August to October (Rainy season)	3.00^{a} (1.87)*	20.5^{a}	75.6^{a} (60.45)**	8.4^{a}
2.	November to February (Winter season)	2.90^{a} (1.84)	20.0^{a}	60.0^{b} (56.2)*	7.9^{a}
3.	March to May (Summer)	2.10^{b} (1.61)	21.7^{a}	60.5^{c} (51.1)*	8.1^{a}
Mean		2.63	20.7	68.3	8.1
SE m±		0.065	0.193	1.141	0.293
CD at 1%		0.190	NS	3.40	NS

** - Arcsine values * - $\sqrt{x+0.5}$ values

Table. 3 Meterological data for investigation period (2004-05) at the study site

Sl. No	Study periods	Mean Weather Parameters		
		Rainfall (mm)	Temperature (º C)	RH (%)
1	Rainy season			
	July	24.8	24.2	79.0
	August	160.7	23.8	83.0
	September	222.1	23.9	79.0
	October	64.6	24.4	75.0
2	Winter season			
	November	0.6	21.1	52.0
	December	0.0	20.0	47.0
	January	0.8	21.4	49.0
	February	0.0	23.0	45.0
3	Summer season			
	March	0.0	27.5	43.0
	April	75.0	28.8	53.0
	May	29.4	29.8	56.0

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