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Inter-specific Competition and Co-existence among Epigeic Earthworms in Polyculture Vermireactors

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A B S T R A C T

Five epigeic species of earthworms namely, *Eisenia foetida, Perionyx sansibaricus, Eudrilus eugeniae, Lennogaster pusillus, Drawida willsi* collectively cultured in polyreactors vermicomposting bins following windrows method. The biomass of different species was observed during different seasons over the years. Of these all epigeic species it was found that *Eisenia foetida*, *Perionyx sansibaricus, Eudrilus eugeniae* and *Lennogaster pusillus* survive well in polyreactors vermicomposting bins. While, *Eudrilus eugeniae* was found best species to adopt polyreactors for the study area. *Perionyx sansibaricus was* found most commonly used species by professional vermiculturist of the studv area.

Introduction

The literature regarding the role of the earthworms is fairly ancient. Aristotle, the Greek Philosopher, referred to them as intestines of the earth because of their habit of ingesting and egesting the soil. In the subtropical regions of Egypt and India, the success of the ancient civilization of the Nile and the Indus Valley was partly due to the fertile soils created by the activity of the earthworms and the continual renewal by the alluvium process. During the Cleopatra era (69-30 BC) the earthworm was declared a sacred animal in the ancient Egypt. Later Darwin remarked that earthworms have p layed more roles throughout the history of the world than any other animal. The remark obviously referred not only to the fertility of the soil, but also to the rapid turnover of the soil and burying under the buildings and other archaeological evidence.

The earthworms has been placed into three major categories *viz*., epigeics, endogeics and aneceics depending on their habitat behavior and ecological strategies (Bouche, 1972).Of the three groups, epigeic forms of earthworms has been reported to be of prime importance from the view point of

vemicomposting (Kale, 1994). It is also because of them being voracious feeder on organic wastes, but utilizing only a small portion for their body synthesis whereas, excreting a large part of the consumed wastes materials in a half digested form (Neuhauser *et al*., 1979). Of the large amount of organic materials consumed by these earthworms' only 5-10 percent could be utilized for their body synthesis. Hartenstein *et al*. (1979) discussed the potential of intensive culturing of selected species of earthworms on organic wastes. Though faunal resources of Indian earthworms are quite rich, ability to inhabit and feed upon high percentage of organic matter, tolerance to disturbance and fluctuations in the environmental parameters, high rate of cocoon production and short duration of life cycle have been conceded the criteria for determining the solubility of earthworm species (Kale, 1991).Of many species of epigeic earthworms tested used for mass cultivation all over the world, including the tropical and temperate regions. *E. foetida*, *E.eugeniae* and *Perionyx excavatus* came in the order of preference for their ability to degrade the wastes and are reported to be very efficient and adoptable in cultures under semi-natural conditions in India (Kale, 1994). The present study aimed to evaluate inter-specific competition and co-existence between all available epigeic species of the study area.

Materials and Methods

Five epigeic earthworm species, *Eisenia foetida, Perionyx sansibaricus, Eudrilus eugeniae, Lennogaster pusillus, Drawida willsi,* species were cultured in polyculture vermireactors in Department of Zoology, Dr HS Gour University, Sagar following Kumar *et al.*,(2010). Biomass of the worms were measured at the end of every season (autumn, winter, spring and summer) of experiment. *Perionyx sansibaricus* was selected as test species, as was largely available in the study area beside *Perionyx excavatus*.

Results and Discussions

Biomass production of all five earthworm species showed remarkable variation in response to seasonal changes (table 1). Biomass of earthworms on fresh weight basis was measured in every case on complete bioconversion at the time of harvesting. It appears the biomass of *E. foetida* varied widely from 49.20 to 80.50g ; *P.sansibaricus* 34.51 to 77.88 g; *E. eugeniae* 34.66 to 80.23 g; *L. pusillus* 10.04 to 29.12 g; *D. willsi* 10.02 to 15.06 g. Highest biomass production of *E. foetida*; *D. willsi* and *L. pusillus* obtained in winter while *P.sansibaricus and E. eugeniae* in autumn. Lowest biomass was recorded in summer for all tested species. Lowest increase in biomass was found in *D.willsi* while highest increase was reported in *E. eugeniae* throughout year including summer. It may be concluded that *E. foetida, P.sansibaricus* and *E. eugeniae* survive well in polycuture vermireactors without affecting the biomass of other species. However, very low increase in biomass of D. *willsi* and *L. pusillus* was reported. Reasons of relative low increase in their biomass need to be further investigated. Both D. *willsi* and *L. pusillus* was abundantly recorded in other composting unit of the study area beside vermicomposting bins.

Table.1 Summary of Means, Standard Deviations, Skewness, Kurtosis, and Alpha Values

Species Combination	Biomass of earthworm on fresh weight (g)* in relation to Seasonal Changes			
	Autumn	Winter	Spring	Summer
Eisenia foetida	73.50(4.90)	80.50 (7.79)	56.85 (6.70)	49.20(3.28)
Perionyx sansibaricus	77.88(8.73)	62.34(7.86)	57.37(6.03)	34.51(3.35)
Eudrilus eugeniae	80.23(7.03)	79.89(7.30)	65.14(7.52)	34.66(8.06)
Lennogaster pusillus	23.40(2.67)	26.82(4.88)	29.12(4.23)	10.04(2.22)
Drawida willsi	10.02(2.67)	12.66(2.11)	15.04(2.99)	14.06(2.99)

*Figures in parentheses indicate biomass increase by number of times over initial inoculation.

Evidence of co-existance between *E. foetida* and *E. eugeniae* was earlier reported by Reinecke and Viljoen (1990) and *P.excavatus* by Kale (2002). Practically no attempt seems to have been made to ascertain level of competition and co-existence among epigeic species in polyculture vermireactors. Inter-specific competition in case of *E. foetida* and *E. eugeniae* was observed by Hartenstein *et al*. (1979) and sensitivity to density pressure was found in *E. eugeniae*. A similar carrying capacity of *E. eugeniae* was also measured to be 0.015g/cc by Kale and Bano and Kale (1988). Kale *et al.* (1986) suggested due to large size and low carrying capacity of *E. eugeniae* led to depend vermiculturist more on *E. foetida*, which was found to tolerate high population density. Reinecke and Hallatt (1989) reported biomass production of *E.foetida* regulated by availability of nutrients from substrate mixture. The quality of food also responsible to regulate growth and maintenance of *Perionyx excavatus* (Kale *et al*., 1982). Beside the environmental conditions the quality and availability of food were reported to influence of *E. foetida* (Hartenstein *et al*, 1979) Increase in biomass production attained 40 to 90 times (Nehauser *et al*., 1979 and Reinecke and Hallatt, 1989). The present study advocates the application of all available epigeic species in polyculture vermireactors to achieve more output of conversion process of earthworms.

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