



(RESEARCH ARTICLE)



## Potential of individual and combination of earthworm species in vermicomposting *Salvinia Molesta*, Mitchell

T Ganesh Kumar \*

Department of Zoology, St. Joseph's College of Arts and Science (Autonomous), Manjakuppam, Cuddalore 600701, Tamil Nadu, India.

International Journal of Science and Research Archive, 2023, 08(02), 280–284

Publication history: Received on 03 February 2023; revised on 25 March 2023; accepted on 27 March 2023

Article DOI: <https://doi.org/10.30574/ijrsra.2023.8.2.0224>

### Abstract

Study is on the performance of earthworm species in vermicomposting salvinia was reported earlier. In this study on the performance of reactors inoculated with single species and combination of two or three species in vermicomposting salvinia is reported. The experiment was carried out on seven set of vermireactors, i.e. mono species - *Eudrilus eugeniae*, *Eisenia fetida*, *Perionyx excavatus*, di species - *Eudrilus eugeniae* + *Eisenia fetida*, *Eisenia fetida* + *Perionyx excavatus*, *Perionyx excavatus* + *Eudrilus eugeniae* and multi species - *Eudrilus eugeniae*, *Eisenia fetida*, *Perionyx excavatus*. The performance of multi-species reactor achieved conversion of about 67% of the feed mass (100 g dry wt,) per fortnight. The vermireactors were sustainable as the animals have remained consistently healthy and reproductive over a period of ten months.

**Keywords:** *Salvinia molesta*; Multi species earthworm; Vermireactor; Vermicompost; Vermicast

### 1. Introduction

In this study on the vermicomposting the weed salvinia was reported. The efficiency of three epigeic earthworm species and three forms of salvinia as feed was tested in reactors operated with only one species. In this study efforts made to compare the performance of the reactors with single species, combination of two or three species in vermicomposting salvinia is reported (Chauhan *et al.*, 2010; Meena *et al.*, 2011; Suthar and Singh, 2008).

### 2. Material and methods

Circular, 4 l plastic containers (dia. 24 cm, depth 9 cm) were utilized as vermireactors. In it twofold layer of jute sheets of 5-mm thickness saturated with water were put at the base of every reactor as vermibed, and the feed, 1 kg of salvinia (dry weight 100 g), was laid over it. In each reactor 15 healthy adult individuals of epigeic earthworms were (mono species - *Eudrilus eugeniae*, *Eisenia fetida*, *Perionyx excavatus*, di species - *Eudrilus eugeniae* + *Eisenia fetida*, *Eisenia fetida* + *Perionyx excavatus*, *Perionyx excavatus* + *Eudrilus eugeniae* and multi species - *Eudrilus eugeniae*, *Eisenia fetida*, *Perionyx excavatus*) introduced. The reactors were lined with 1.5-mm nylon mesh held set up with an elastic band to keep earthworm from getting away and evade interruption of different life forms. On that polyethylene sheets in black color was placed, as earthworms sensitive to light and build the nourishing circumstances in day time also. The detail of earthworm species and the numbers are summarized in Table 1.

\*Corresponding author: T Ganesh Kumar

**Table 1** Single/combination of earthworm species in each reactors

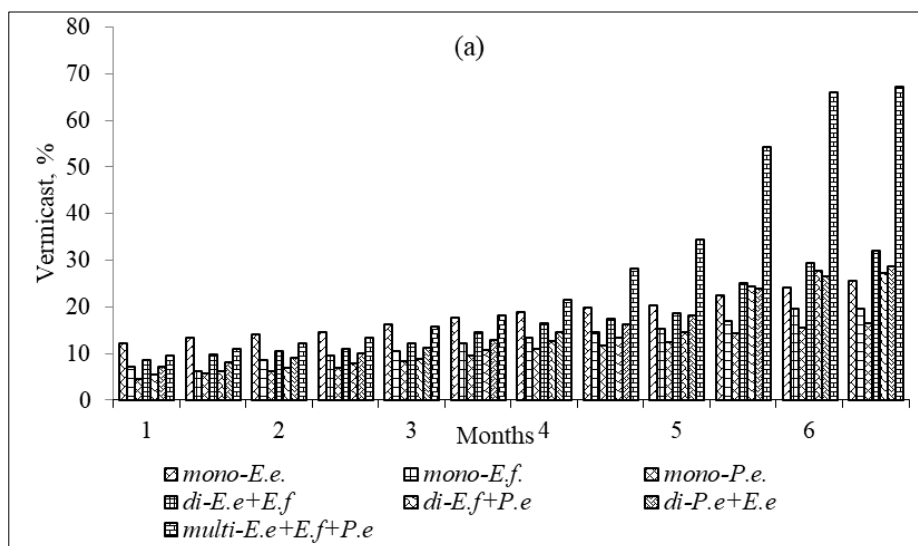
No. of reactors (in duplicate)	Earthworm species	Number of earthworms
	Reactors with single species	
1	<i>Eudrilus eugeniae</i>	15
2	<i>Eisenia fetida</i>	15
3	<i>Perionyx excavatus</i>	15
	Reactors with two species	
4	<i>Eudrilus eugeniae</i> + <i>Eisenia fetida</i>	8+7=15
5	<i>Eisenia fetida</i> + <i>Perionyx excavatus</i>	8+7=15
6	<i>Perionyx excavatus</i> + <i>Eudrilus eugeniae</i>	8+7=15
	Reactors with multi - species	
7	<i>Eudrilus eugeniae</i> + <i>Eisenia fetida</i> + <i>Perionyx excavatus</i>	5+5+5=15

Seven sets of reactors all run in duplicate, were started with single species *E.eugeniae*, *E. fetida* and *P. excavatus* in independent reactors and blend of two species *Eudrilus eugeniae* +*Eisenia fetida*,*Eisenia fetida* + *Perionyx excavatus*, and *Perionyx excavatus* + *Eudrilus eugeniae* and a multi-species category *Eudrilus eugeniae*, *Eisenia fetida*, *Perionyx excavatus*.

The vermireactors operated in semi-continuous mode were disbanded once in every 15 days, to evaluate vermicast generation, live bio-mass and population as detailed in previous chapters.

### 3. Results and discussion

The results of vermicast output, in terms of fraction of substrate converted in each of the fifteen-day run and vermicast produced are outlined in Figure. 1. There was significant difference (ANOVA) in performance among the reactors. Comparatively, the vermicast from multi-species reactor showed better performance over mono and double sp., reactors. The difference in vermicast output between each of the three single species reactors versus multi-species was statistically significant ( $F= 9.476, p<0.001$ ).

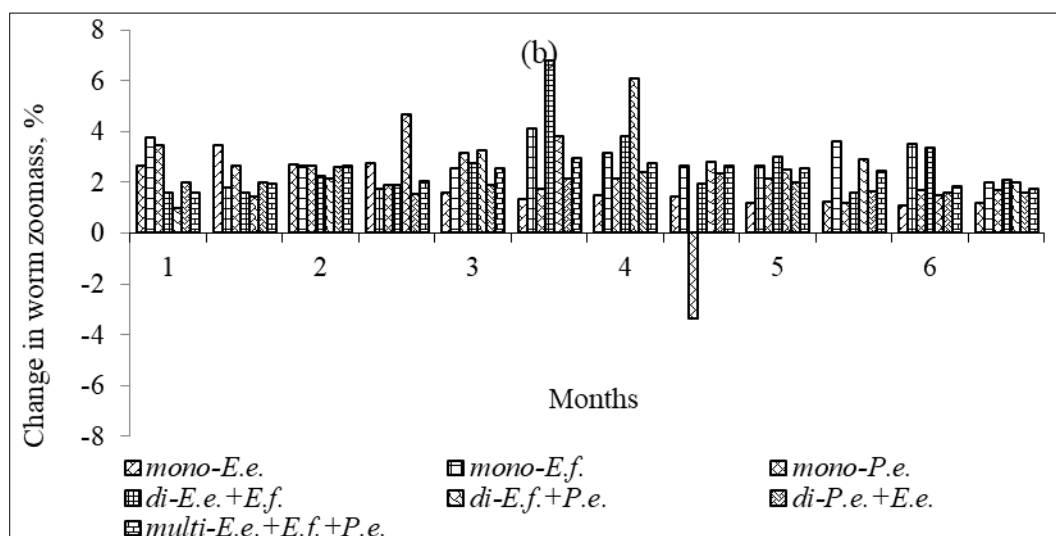


**Figure 1** Vermicast recovery, %, as function of time in reactors operated with mono, di and multi species

Among single species reactors, the difference in performance was statistically significant between *E. eugeniae* and *P. excavatus* ( $p < 0.01$ ), whereas the difference between *E. fetida* and *P. excavatus* or *E. eugeniae* and *E. fetida* was not significant. The difference in vermicast generated in reactors with *P. excavatus* alone versus reactors operated with *E. eugeniae* + *E. fetida* (two species combination) was statistically significant at  $p < 0.05$ . In all other cases, the difference in vermicast output was not significant.

**Table 2** Vermicast recovery, %, in reactors operated with single species, combination of two/three species

Average vermicast recovery, %							
	1	2	3	4	5	6	7
	Mono- <i>E. eugeniae.</i>	Mono- <i>E. fetida.</i>	Mono- <i>P. excavatus.</i>	Di- <i>E. eugeniae.+ E. fetida.</i>	Di- <i>E. fetida+ P. excavatus.</i>	Di- <i>P. excavatus.+ E.eugeniae.</i>	Multi- <i>E.eugeniae +E.fetida +P.excavatus</i>
1	12.2	7.4	4.6	8.8	5.6	7.2	9.6
	13.4	8.4	5.8	9.8	6.4	8.2	11
2	14.2	8.8	6.4	10.6	7	9.2	12.2
	14.8	9.6	7	11	8	10.2	13.4
3	16.4	10.6	8.6	12.4	9	11.4	16
	17.8	12.2	9.6	14.6	10.8	13	18.4
4	19	13.6	11	16.6	12.8	14.8	21.6
	20	14.6	11.8	17.6	13.4	16.4	28.4
5	20.4	15.4	12.6	18.8	14.8	18.2	34.6
	22.6	17.2	14.5	25.2	24.4	24	54.4
6	24.3	19.8	15.6	29.6	27.8	26.6	66.2
	25.6	19.8	16.6	32.2	27.4	28.7	67.4



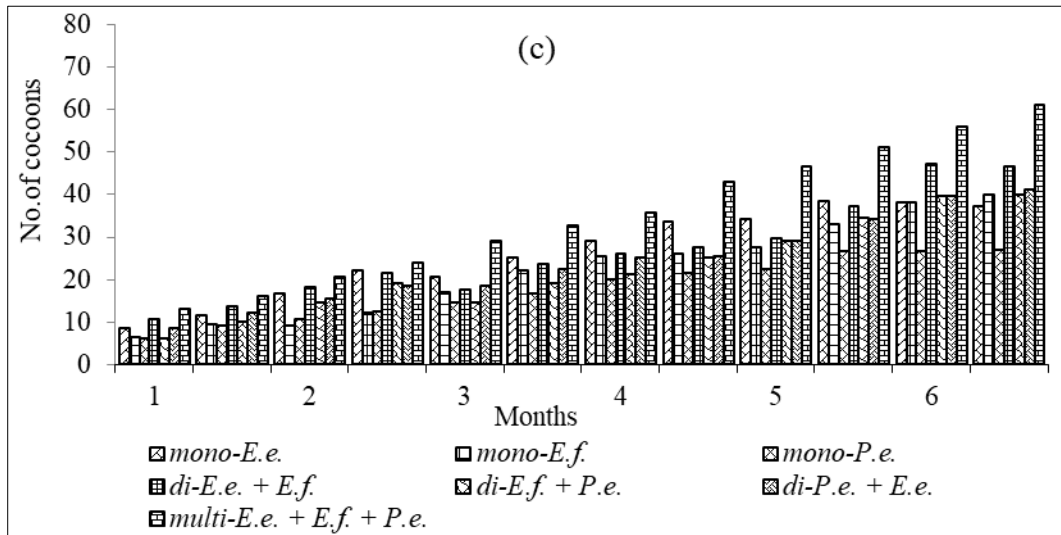
**Figure 2** Change in zoomass in vermireactor with individual and multi-species with salvinia as feed

The highest vermicast output observed from multi-species (*E. e.* + *E. f.* + *P. e.*) vermireactor was 67.4% at the end of the 6<sup>th</sup> run, followed by two species - *E. eugeniae.*+*E. fetida.*, 32.2%, *P. excavatus.*+*E. e.*, 28.7%, *E. f.*+ *P. e.*, 27, single species -*E. e.*,

25.6%, *E.f.*, 19.8% and *P.e.*, 16.6% in the 6<sup>th</sup> run. Despite the fact that blended worm vermireactors substantiated themselves as higher yield performers, and among blended worm reactors, multi-species (*E. e.* + *E. f.* + *P. e.*) proved they are extraordinary.

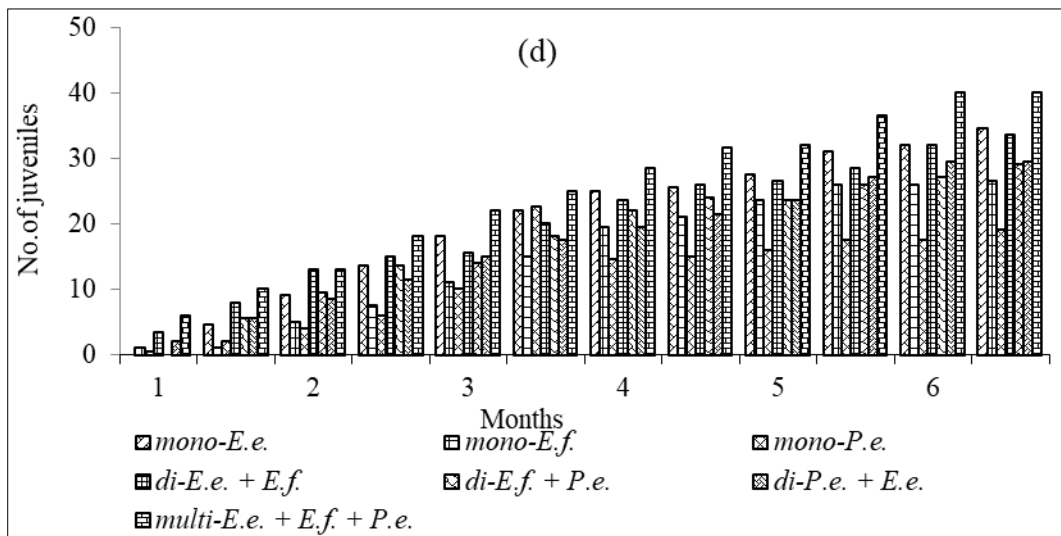
All the vermireactors indicated positive change in zoomass in most of the runs. The reactor with two species - (*E. e.* + *E. f.*) has shown the highest (6.8%) increase in zoomass in the 3<sup>rd</sup> run. In reactor with multi-species there was no mortality as well as fall in biomass until the end of the experiment.

In reactor operated with *P. excavatus* alone, there was fall in zoomass, otherwise all other reactors there was no mortality or negative change in zoomass (Figure 2).



**Figure 3** Number of cocoons in vermireactors with single, two and three of earthworm species with salvinia as feed

The earthworms in all the vermireactors consistently produced cocoons. The reactors with multi- (*Eudrilus eugeniae* + *Eisenia fetida* + *Perionyx excavatus*) produced most number of cocoons than rest of reactors followed by two species - (*Eudrilus eugeniae* + *Eisenia fetida*), (*Perionyx excavatus* + *Eudrilus eugeniae*), single species - (*Eudrilus eugeniae*), (*Eisenia fetida*) two species - (*Eisenia fetida* + *Perionyx excavatus*) and single species - (*Perionyx excavatus*) as may be seen from Figure 3.



**Figure 4** Number of juveniles observed in vermireactors operated with single, two and three of earthworm species with salvinia as feed

The number of hatchlings are also more in the reactors with multi species - (*E. e.* + *E. f.* + *P. e.*) followed by di-(*E. e.* + *E. f.*), mono-(*E. e.*), di-(*P. e.* + *E. e.*), di- (*E. f.* + *P. e.*), mono-(*E. f.*) and mono-(*P. e.*), as may be seen from Figure 4.

---

#### 4. Conclusion

- Reactors with combination of three earthworm species (*Eudrilus eugeniae* + *Eisenia fetida* + *Perionyx excavatus*) performed better compared reactors with combination of two species or single species, in terms of vermicast production, growth and reproduction.
- There was neither mortality nor negative change in zoomass observed with any of the reactor with mixed species until the end of the experiment.

---

#### Compliance with ethical standards

##### *Acknowledgments*

Author grateful to his PhD guide Dr.S. Gajalakshmi, Associate Professor, Centre for Pollution Control and Environmental Engineering, Pondicherry University.

##### *Disclosure of conflict of interest*

There is no conflict of interest.

##### *Statement of ethical approval*

The present work does not harm any animals by the author.

---

#### References

- [1] Chauhan, A., kumar, S., Singh, A.P., and Gupta, M. Vermicomposting of vegetable wastes with cowdung using three earthwork species *Eisenia fetida*, *Eudrilus eugeniae* and *Perionyx excavatus*, *Nature and Science*, 2010:8 (1).
- [2] Meena, K., and Ajay, S. K. Vermicomposting of vegetable waste amended with cattle manure. *RJCM*, 2011.vol 1(8), 49-56.
- [3] Suthar, S., Singh, S. Comparison of some novel polyculture and traditional monoculture vermicomposting reactors to decompose organic wastes. *Ecological Engineering*, 2008.33, 210-219.

---

#### Authors short Biography



I am **Dr. T. Ganesh Kumar**, M.Sc., MPhil., PhD., an assistant professor in the department of zoology at St. Joseph's College of Arts and Science (Autonomous), Cuddalore-1. I hold degrees in environmental science and technology from the B.Sc. to the Ph.D. 2018 saw the awarding of my Doctorate by Pondicherry Central University. I was a Rajiv Gandhi National Fellow from 2010 to 2015 while doing my Doctorate. I have published six papers includes Bioresources and Bioprocessing (BIOB) and two books (LAP, Germany) throughout the past six years of research and teaching. My research interests are in weed and earthworm vermicomposting. IUCN (International Union for Conservation of Nature) and UNEP both have me as a member (United Nation Environment Programme).