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CONTROLLED USE OF TERMITES IN ASSIMILATIVE DISPOSAL OF THE POISONOUS WEED, *PARTHENIUM HYSTEROPHORUS*

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ABSTRACT

Parthenium hysterophorus L, (Asteraceae) an invasive species, is recognized as one of the leading threats to biodiversity. It imposes tremendous costs on agriculture, forestry, fisheries, wetlands, roadsides, natural areas, and other human enterprises, including human health, thus taking a heavy economic toll every year worldwide. As parthenium produce large quantities of seed and hence there are higher possibilities of dissemination, management of this weed is a difficult task. Thus, parthenium is a weed of national significance. The present study describes attempts made to dispose the weed by termigradation. Parthenium of 5kg to 30kg capacity was used in the termireactors. More than 40% of the substrate was disposed within 30 days.

Keywords: Termites, Parthenium hysterophorus, Termigradation and Termireactors.

I. INTRODUCTION

Parthenium hysterophorus L, occurs commonly in the wastelands and agricultural field throughout the world. It is highly adaptable and it grows everywhere invading all types of pasture lands which his leads to substantive loss in the yield of agriculture ([1],[2], [3],[4] and [5]). The other aspect of the weed is the health hazard [6]. This weed creates health impacts to human being like dermatitis [7] while conduct directly and also their pollens cause fever and asthma fever and asthma ([8], [9], [10], [11] and [12]). For animals it causes impacts like rashes on their body and udders [13] also greater loss of yield and bitter taste in the milk of cattle [14].

II. PRESENT STRATEGY OF PARTHENIUM MANAGEMENT

Since the time that the weed parthenium turned into a danger in India and different nations, attempts are being made to dispose the weed by different techniques. As established in the case of several aquatic and terrestrial weeds, the physical and chemical method of disposal of parthenium is tedious, expensive and not sustainable. Hence there are attempts made on biological methods of weed control by either composting or vermicomposting or anaerobic digestion. All these methods exhibit their own advantages and disadvantages. The study of allelopathic effects of parthenium root, stem and leaf on the germination and seedling development of wheat cultivation [15].

The allopathic impact of parthenium compost on germination and development of groundnut *Arachis hypogeae* [16]. A report of high level of N, P and K in Parthenium compost [17]. The author has accounted for the significant components of nitrogen, phosphorus and potassium level two times more in parthenium manure than homestead yard fertilizer [18]. Composted parthenium has the high concentration of N, P, K, Fe, Mn, Cu and Zn and beneficial for the crop yields [19]. The reduction in phenolic content in parthenium compost with help of millipede was demonstrated [20]. The study of vermicomposting of parthenium with *Eisenia fetida*[21]. The author was used six weeds in dry and fresh form to study the decomposition pattern and methanogenic activities to optimize for solid phase digestion. The results revealed that use of mixed biomass feed stock showed better chance of stable biogas production, conversion efficiency and gas yield [22]. Hence all these studies show that parthenium require either cattle dung or other supplementation such as other feed stock etc for composting or vermicomposting or anaerobic digestion. All these add to the cost of the process. Hence termigradation, a low cost technology, was explored.

After extensive proof-of-concept studies, on termigradation ([23], [24], and [25]) which are promising, utilization of parthenium by termigradation is detailed in this chapter.

III. MATERIAL AND METHODS

Three set of experiments were conducted with different quantities of parthenium ranging from 5kg to 30kg. Parthenium twigs of 15-20 cm length were packed in reactors and placed near active termite mounds in the Pondicherry University campus.

The first experiment was preliminary study in which 5kg of parthenium was tested for termite activity. Later the quantity of weed was increased to 10kg and then to 30 kg. In order to lure significant number of termite towards the weed, so that the processing of the weed will be quicker, baits were used as trails from eight directions towards the mound. These baits would increase the number of termites towards the reactors, thereby causing quicker assimilation of weeds. The trails were made by paper waste, cardboard and saw dust of 5 meter length and an inch thick from the substrate in eight directions at equal distance from each other (Fig. 1.1a).The reactors were observed everyday and the termite species processing the waste was noted. The substrate consumption rate was assessed once in every 15 days.

(a) (b)

FIGURE 1.1 (a) Termireactor with trails (b) parthenium being processed inside the reactor.

The substrate consumption was calculated once in every 15 days and the total time period of each experiment was about 60-90 days. Every 15 days interval, the termireactor was dismantled and the substrate was separated from the termites, soil particles and other debris and weighed. About two sets of two 100g termigraded substrate were taken randomly from the termireactor and brought to laboratory for dry weight estimation. All the calculations were done on the basis of dry weight. After taking dry weight the substrate were replaced to the termireactor. This procedure was repeated for the subsequent runs till the substrate is fully termigraded.

IV. RESULTS AND DISCUSSION

The substrate being processed by termites and the tunnels constructed during the process is shown in Fig. 1.1b. In the termireactor with 5kg parthenium operated without trails, the termite consumed 24.7% of the substrate in 15 days. The substrate consumption (cumulative) then increased in the subsequent runs (Table 1.1 and Fig. 1.2). In the reactors with 10 kg parthenium, operated with trails, the substrate consumption was 24.9% in the first run and then increased upto 98.4% in 105 days (Table 1.2 and Fig. 1.3). Table 1.3 and Fig. 1.4 represents the termigradation of parthenium in reactors with 30 kg feed. In 105 days, 96.2% of parthenium was processed. In all the reactors, *Hypotermes obscuriceps* was the termite species recorded [26]. In all the reactors more than 40% of the feed was processed in 30 days. This can be considered as fairly efficient process as this technique does not require supplementation of cattle dung as in the case of composting or vermicomposting of this weed

Days	**Reactor**			**Termigradation**	
	A	**B**	**C**	**During each run**	**Cumulative**
15	26.3	25.1	22.7	24.7 ± 1.8	24.7 ± 1.8
30	21.4	20.7	19.4	20.5 ± 1.0	45.2 ± 2.8
45	15.5	18.4	16.7	16.8 ± 1.4	62.0 ± 2.9
60	10.7	11.6	13.3	11.8 ± 1.3	73.9 ± 1.8
75	7.8	9.3	9.4	8.8 ± 0.9	82.7 ± 2.0
90	5.9	6.8	7.8	6.8 ± 0.9	89.6 ± 2.2
105	3.2	3.2	5.1	3.8 ± 1.1	93.4 ± 2.3

reported by other authors.

dung availability in urban areas is not common and hence procurement adds to the cost of any system. An experimental study was reported of composting P.hysterophorus and *Eichhornia crassipes*, separately and both

together. The combining composting of *P.hysterophorus* and *Eichhornia crassipes* reduced the allopathic effect and also increased the nutrient quality of compost [27]. The compost prepared from green cutting of parthenium by NADEP composting method showed more N, P, and K than dry parthenium and control [28]. A high concentration of N, P, K and other micronutrients in composted parthenium was reported [19]. The studied emergence and growth experiments of lettuce with composted parthenium and reported that the compost generated from parthenium and other plant materials exhibited reduced allopathic inhibition effect on lettuce emergence rate, radicle and plumule growth than composting of parthenium alone[29]. Vermicomposting of parthenium has been attempted with cow dung [30], [31a, b], [32] and [33]. All the above studies indicate that the system are all cow dung dependent which adds to the cost of system and termigradation do not require cow dung. Hence the process can be considered cheaper for the processing of ligninous waste.

TABLE 1.1 Extent of Termigradation (%) of Parthenium Weed (5 Kg) at 15-Day Intervals

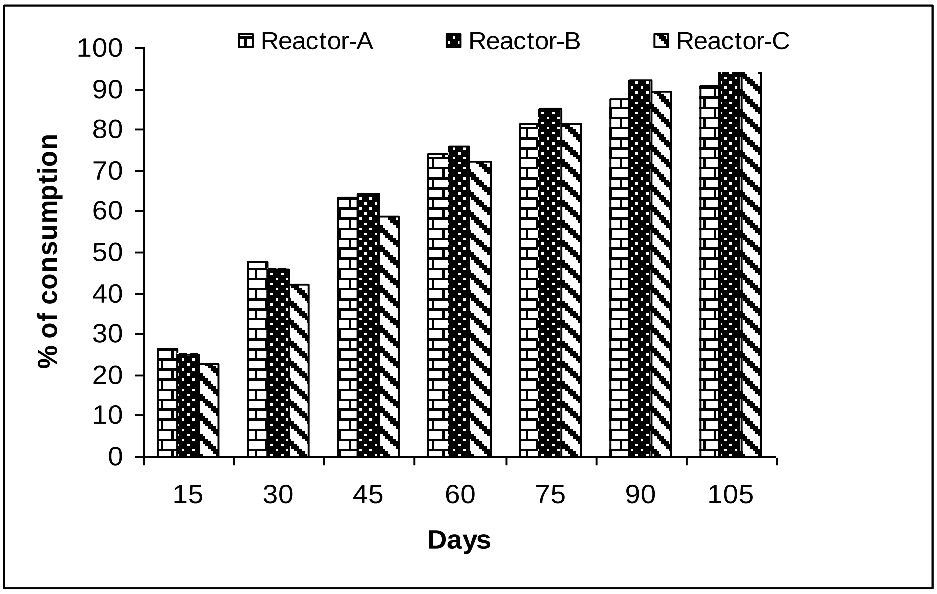

FIGURE 1.2 Cumulative consumption of parthenium, %, in termireactors with 5 kg of weed

TABLE 1.2 Extent of termigradation (%) of parthenium weed (10 Kg) at 15-day intervals, supported by trails

Days	Reactor			Termigradation	
	A	B	C	During each run	Cumulative
15	24.8	25.1	24.8	24.9 ± 0.2	24.9± 0.2
30	20.1	20.3	19.3	19.9 ± 0.5	44.8 ± 0.7
45	17.2	18.7	17.5	17.8 ± 0.8	62.6 ± 1.3
60	14.6	14.3	13.6	14.1 ± 0.5	76.7 ± 1.6
75	11.3	10.2	11.4	10.9 ± 0.7	87.7 ± 1.0
90	7.6	7.3	7.1	7.3 ± 0.2	95.0 ± 1.2
105	3.2	2.4	4.6	3.4 ± 1.1	98.4 ± 0.3

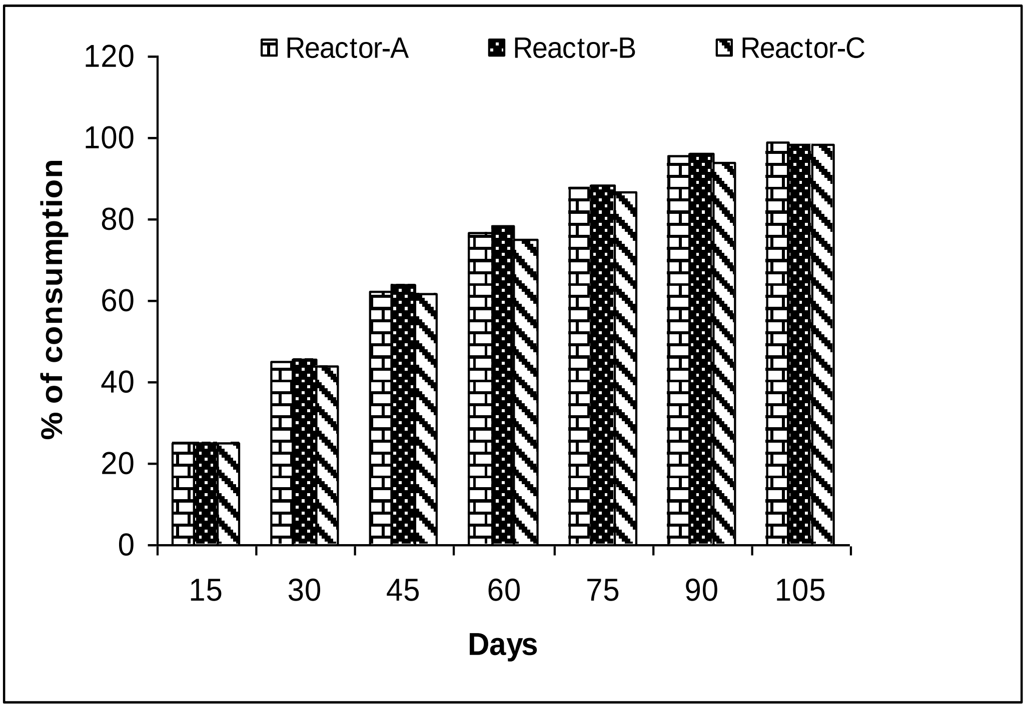

Figure 1.3 Cumulative consumption of parthenium, %, in termireactors with 10 kg of weed supported by trails

TABLE 1.3 Extent of termigradation (%) of parthenium weed (30 Kg) at 15-day intervals, supported by trails

Days	Reactor			Termigradation	
	A	B	C	During each run	Cumulative
15	25.6	25.1	24.7	25.1 ± 0.4	25.1 ± 0.4
30	19.3	19.3	18.2	18.9 ± 0.7	44.0 ± 1.0
45	16.1	16.7	16.4	16.4 ± 0.3	60.4 ± 1.0
60	14.8	14.6	13.5	14.3 ± 0.8	74.7 ± 1.8
75	11.5	11.8	9.1	10.8 ± 1.5	85.5 ± 3.2
90	7.3	7.4	6.2	6.9 ± 0.7	92.5 ±3.9
105	3.1	3.2	4.7	3.6 ± 0.9	96.2 ±3.0

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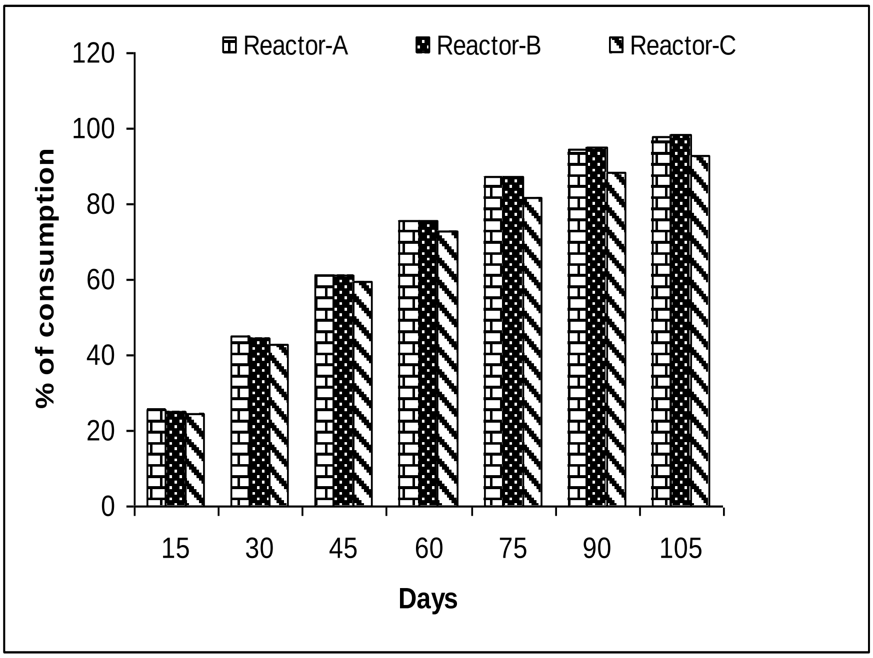

Figure 1.4 Cumulative consumption of parthenium, %, in termireactors with 30 kg of weed supported by trails

V.CONCLUSION

Disposal of the weed parthenium by termite action was started with 5 kg to 30 kg of the substrate. More than 40% of the substrate was processed in 30 days in all the reactors.

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