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Pesticide Effects of Organic Fertilizer on Rhizophora Seedlings

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***Abstract*: Insects impose widespread damage to Mangrove leaves and in severe cases even kill the Mangrove trees. Controlling of them through natural method is necessary because they are eco-friendly. The present study deals with Pesticide effect of Panchagavya and Jeevamrutham that intensify plant growth and ameliorate soil health. This study carried on period of March to May 2021 in Pichavaram, Chidambaram, Tamil Nadu, India. These two organic fertilizers were prepared through the fermentation process of cow products milk, curd, ghee, urine and dung. Jeevamrutham is more effective when the plant is in its early stage of growth. Panchagavya is an effective after the first stages of growth. Both fertilizers were reported in efficient antibacterial effect. Conclusion of this study, we reported both fertilizers them as the efficient natural plant growth stimulants. Moreover, the Pesticide activity of fertilizers was studied in Mangrove seedlings against the dangerous pests and its antibacterial activity was also scrutinized.**

***Keywords*: Insects, Mangrove, Organic fertilizer and Pesticide effect**

I. Introduction

Insects impose widespread damage to Mangrove leaves and in severe cases, the leaves get dried, dropped off and the entire seedling died which leads to serious destruction in mangroves, even kill the Mangrove trees (Kathiresan *et al*., 2001). The common damages like holes, galls, minor attacks, necrotic spots and incursions occur in leaf margin. Pests during their larval stage feed mainly on the leaves and sometimes, bark of mangrove trees. The caterpillar is very common and causes severe damage to leaves of *Rhizophora* spp., Around six species of caterpillars, five species of grasshoppers, two species each of semi-loppers, snails, and weevils, and one each of leaf miner, skeletonize, and bagworm were identified as defoliating pests that affect mangroves. The insects induced damage in the mangroves is a very important thing in the environment.

Mangroves are one among the foremost dynamic ecosystems in the world. Mangroves are an unique plant formations growing under highly stressed habitats along tropical and subtropical regions. *Rhizophora* is a genus of tropical mangrove trees in the family of Rhizophoraceae. They are collectively called true mangroves. The caterpillar larvae tussock mouth is very familiar that causes severe damage to *Rhizophora* leaves. The leaf area damage in *Rhizophora* sp. is around 0.74% to 2.69%. Controlling of insects in the organic way is necessary because they are eco-friendly. Organic manures are the best natural soil improvement; they contain nitrogen in high amount**.** Panchagavya and Jeevamrutham to be efficient plant growth stimulants. Panchagavya show high prospective as an organic fertilizer and pesticide (Dhama *et al*., 2005). Jeevumrutham is extremely commercial for the grower (FAO, 2016). This study mainly focused on pest control and growth stimulants of *Rhizophora* seedlings using organic fertilizers Panchagavya and Jeevamrutham.

II. Materials and Methods

Study Area and Identification

A study and identification of pests in the mangrove area was done in Pichavaram, Tamil Nadu, India in Figure- 1. Identification of insects was done with the help of the application Google lens, field guides and Entomologists. Field observation of insects was made from the period of March to May 2021. Infected mangrove leaves were analyzed in the Department of Entomology to investigate whether the infestation is due to pest or not and identify the pest.

Figure 1: Geographical location of Pichavaram (https://incois.gov.in/portal/OON.jsp)

Methodology

Nursery-based pest control management practice was followed in this study. The seedlings of *Rhizophora mucronata* were collected from the mangrove area of Pichavaram on the east coast of Tamil Nadu, India. Then the healthy seedlings was washed thoroughly in the tap water and planted individually in polythene bags (16 X 30cm), which was filled with the homogenous mixture of the red soil, sand and farmyard manure mixed in the ratio of 1:2:1 with following inputs. Each treatment used 30 *Rhizophora* seedlings.

Preparation of organic fertilizers

In this study two organic fertilizers Panchagavya and Jeevamrutham was preparing with help of aerobic fermentation method following the protocol (Dev P et al., 2022).

Panchagavya

* Cow dung – 1.5 kg
* Cow ghee – 250 gm
* Cow Urine – 2.5 liters
* Water – 2.5 liters
* Cow milk – 500ml
* Cow curd – 200ml
* Tender coconut water – 500ml
* Sugarcane juice – 200ml
* Well ripened poovan banana – 4 nos.

The Cow dung and ghee both mixed well in the morning and evening hours for 3 days and keep undisturbed. After 3 days of the mixing, the cow urine and water were added. Regular mixing was done in the morning and evening hours and kept for 15 days. After 15 days, cow milk, curd, tender coconut water, sugarcane juice and poovan banana were added and mixed well. The ingredients were stirred well twice a day (*i.e.*), morning and evening. All the above items were added in a wide-mouthed plastic tub. The plastic tub was kept open under shade. The Panchagavya stock solution was ready after 30 days. It was kept in the shade and covered with a wire-net to prevent it from houseflies laying eggs and the formation of maggots in the solution (Sarkar *et al.,* 2014). 3% solution was found to be the best compared to other concentrations investigated. Three liters of Panchagavya solution diluted in 100 liters of water is ideal for all crops.

Jeevamrutham

* Cow dung – 1/2 kg
* Cow Urine – 1/2 liter
* Jaggery – 100 gms
* Flour (Bengal gram/ Green gram/ Black gram. For better results, make flour out of sprouted gram) - 100 gms
* Soil, free from chemical fertilizer and pesticide – a handful
* Water, free of chlorine – 10 liters

3 liters of water was taken in a plastic bucket and added with cow dung, cow urine, jaggery basin powder, and one handful of soil. Stir well the mix without any lumps. To this mixture, 7 liters of water was added to make it to 10 liters. This plastic container was kept in the shade and covered with cloth. Stir well the mixture during morning and evening times. Jeevamrutham got ready in 2 days and was directly sprayed to the plants.

Foliar spray method was applied to the *Rhizophora* leaves with the prepared organic fertilizers (Tharmaraj *et al.,* 2011). The treatments were done continuously for more than 45 days, twice a day under optimal conditions. The growth parameter of the plant was measured based on Plant shoot height, No. of insect affected leaves/plant and No.of healthy leaves/plant separately for control, Panchagavya and Jeevamrutham. 3% Panchagavya and Jeevamrutham was used as treatment.

Statistical Analysis

Statistical analysis was performed using One-way analysis of variance (ANOVA) and followed by least square difference. Results were expressed as mean ± SD from three replications. The P values < 0.01 were considered significant. And the graphical representation of antibacterial activity result was done in Prism-Graph Pad software.

III. Results and Discussions

Over sixteen species of insects belong to the 15 families and five orders were identified during this study period of March to May 2021 from the mangrove environments (Table 1). Among them, Lepidoptera was found to be the dominant order followed by Hemiptera, Coleoptera, Hymenoptera, and Diptera. The Dominant order of insects observed in Pichavaram mangroves is Lepidoptera (Balakrishnan, *et al.,* 2014). In the present study, more insects were identified under the Lepidoptera order followed by others. The growth parameters of the plant were measured by control, Panchagavya and Jeevamrutham in Table 2, 3 & 4 respectively.

On 15th day of treatment the plant shoot height was measured as 12.1±0.1 cm for control, 15.3±0.2 cm for

Panchagavya treated plant and 14.8±0.1 for Jeevamrutham treated plant. The no. of affected leaves/plant was measured as 20.2±0.1 in control plants, 18.3±0.1 in Panchagavya treated plants and 12.0±0.1 in Jeevamrutham treated plants. The no. of healthy leaves/plant was also noted the for control plants as 2.1±0.1, for Panchagavya treated plants as 6.6±0.1 and for the Jeevamrutham treated plants as 5.0±0.1 respectively.

TABLE 1
Identified insects of mangrove plants from Pichvaram

S. No	Order	Family	Species
1.	Coleoptera	Curculionidae	*Otiorhynchus sulcatus*
		Chrysomelidae	*Monolepta sp*
		Buprestidae	*Agrilus sp*
2.	Hemiptera	Coccidae	*Saissetia oleae*
		Diaspididae	*Aspidiotus destructor*
		Pyrrhocoridae	*Dysdercus cingulatus*
3.	Hymenoptera	Formicidae	*Llinepithema humilis* *Camponotus sp*
4.	Diptera	Culicidae	*Culex sp*
5.	Lepidoptera	Erebidae	*Euproctis sp*
		Lymantriidae	*Dasychira sp*
		Gracillariidae	*Phyllocnistis sp*
		Pyralidae	*Nephopterix sp*
		Tortricidae	*Capua endocypha*
		Depressariidae	*Odites sp*
		Nymphalidae	*Danaus melanippus*

TABLE 2
Plant growth parameters of an organic fertilizer in 15th day of treatment

15th -Day Treatments	Plant Shoot height(cm) (Mean ± S.E)	No. of insect affected leaves/plant (Mean ± S.E)	No. of healthy leaves/plant (Mean ± S.E)
Control	12.1±0.1	20.2±0.1	2.1±0.1
Panchagavya (3%)	15.3±0.2	18.3±0.1	6.6±0.1
Jeevamrutham (3%)	14.8±0.1	12.0±0.1	5.0±0.1

TABLE 3
Plant growth parameters of an organic fertilizer in 30th day of treatment

30th -Day Treatments	Plant Shoot height(cm) (Mean ± S.E)	No. of insect affected leaves/plant (Mean ± S.E)	No. of healthy leaves/plant (Mean ± S.E)
Control	14.2±0.2	23.8±0.1	2.2±0.1
Panchagavya (3%)	18.5±0.2	11.4±0.1	8.0±0.1
Jeevamrutham (3%)	17.4±0.3	10.1±0.1	6.4±0.1

TABLE 4
Plant growth parameters of an organic fertilizer in 45th day of treatment

45th -Day Treatments	Plant Shoot height (cm) (Mean ± S.E)	No. of insect affected leaves/plant (Mean ± S.E)	No. of healthy leaves/plant (Mean ± S.E)
Control	17.3±0.2	25.2±0.1	2.2±0.1
Panchagavya (3%)	22.6±0.3	6.4±0.1	10.4±0.1
Jeevamrutham (3%)	20.8±0.3	6.6±0.1	8.5±0.1

On 30th day of treatment the plant shoot height was measured as 14.2±0.2 cm for control, 18.5±0.2 cm for Panchagavya treated plant and 17.4±0.3 for Jeevamrutham treated plant. The no. of affected leaves/plant was measured as 23.8±0.1 in control plants, 11.4±0.1 in Panchagavya treated plants and 10.1±0.1 in Jeevamrutham treated plants. The no. of healthy leaves/plant was also noted the for control plants as 2.2±0.1, for Panchagavya treated plants as 8.0±0.1 and for the Jeevamrutham treated plants as 6.4±0.1 respectively.

On 45th day of treatment the plant shoot height was measured as 17.3±0.2 cm for control, 22.6±0.3 cm for Panchagavya treated plant and 20.8±0.3 for Jeevamrutham treated plant. The no. of affected leaves/plant was measured as 25.2±0.1 in control plants, 6.4±0.1 in Panchagavya treated plants and 6.6±0.1 in Jeevamrutham treated plants. The no. of healthy leaves/plant was also noted the for control plants as 2.2±0.1, for Panchagavya treated plants as 10.4±0.1 and for the Jeevamrutham treated plants as 8.5±0.1 respectively.

Naskar, S., and Kumari, M. (2024) reported that liquid formulations such as Beejamrutha, Jeevamrutha, and Panchagavya promote crop growth, yield, and quality of plants. Panchagavya contains all the essential macro and micronutrients which is vital for plant growth (Selvaraj *et al*., 2007). They have shown a larger beneficial effect in dropping disease and they work as a pest repellent (Swaminathan *et al*., 2007). The yield was doubled in annual sprayings and giving resistance to pests and diseases (Vivekananda, 1999). The 3 percent treatment produced the highest plant height, number of branches per plant, leaf number, leaf area, fresh and dry weight of the plant, number of fruits per plant, and total yield among the five treatments. (Deore *et al*., 2010).

Jeevamrutham is organic liquid manure made of cow products that is an excellent source of macronutrients and micronutrients which are required for the plant growth. Jeevamrutham to supply of nutrient to plants through enhanced microbial activity (Krishnan, 2023). The beneficial effects of Jeevamrutham were reported by Vasanthkumar, 2006 and Devakumar *et al*., 2008 attributed to higher microbial load and growth hormones. They resulted in better growth and yield of crops. Maximizing nutrient availability in Jeevamrutham is at pH 6.5 to 7.8**.** Jeevamrutham showed increased growth and yield when applied as a seed treatment, foliar spray, and soil application too. 5- 11% of yield is increased when Jeevamrutham is applied as a seed treatment (Devakumar *et al*,

2008). Jeevamrutham with the combination of other liquid formulations such as Panchagavya has yielded good results in capsicum (Boraiah, 2013).

Experiments conducted by Reshma Sutar *et al.,* (2015), showed significant increase in growth parameters such as number of pods per plant, length of pods, pod weight, number of seeds per pod, seed weight per plant and 100 seed weight with the application of 1000 liters of jeevamruth and 7.5% panchagavya per hectare. After meticulous treatment of Panchagavya and Jeevamrutham the changes in the growth parameters of *Rhizophora* seedlings shows effective results.

IV. Conclusion

This study period recorded 16 species of insects that belongs to the 5 Orders. Panchagavya and Jeevamrutham were prepared under aerobic fermentation process. These fertilizers not only increase the growth of the plants but also prevent the plants from several pest attacks. Jeevamrutham is more effective when the plant is in its early stage of growth. Panchagavyam is an effective after the first stages of growth. Both techniques are very less expensive compared to chemical fertilizers and the materials used in the preparation of fertilizers are eco-friendly and organic. They did not affect the plant growth either soil fertility in any way. So both organic fertilizers can be easily replaced with chemical pesticides for controlling the pests that affect the plants.

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