Vermicompost Tea: Effects on Germination of Saluyot (*Corchorus olitorius)*

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Abstract

Agriculture sector is under pressure in producing more foods in order to feed the growing population. Thus, utilization and promotion of indigenous vegetable will seek to address and resolve the problem to strengthen food security and at the same time conserving the biodiversity of Philippines' indigenous vegetables. Organic products are in demand at present due to health awareness. Vermicompost tea is a liquid biofertilizer that able to boost up the growth and productivity of wide variety of plants. Hence, the study was conducted to investigate effects of vermicompost tea as germination enhancer *C. olitorious* and to identify treatments that able to improve the seed germination of *C. olitorious.* Experiment was arranged in a Complete Randomized Design with 3 replications. Result shows that 10% vermicompost tea was the most effective to enhance seed germination of *C. olitorious*. In addition, it able to enhance the germination percentage, root and shoot length and vigor index compared to GA3. Furthermore, correlation analysis shows that seedlings with higher vigor index has a longer root and shoot length and higher germination percentage. Thus, lower concentration of vermicompost tea is effective compared to GA3 as seed germination enhancer and it is a cost effective and safe alternative chemical for improving the seed germination of *C. olitorious.*

Keywords: Vermicompost Tea; *Corchorus olitorious;* Germination; Indigenous Vegetables; Philippines

1. INTRODUCTION

Philippines is abundant of underutilized indigenous plants that are palatable and resistant to pests and diseases, as well as being tolerant to drought and natural hazards. The promotion of indigenous vegetable will seek to address and resolve the problem to strengthen food security, improve nutrition and the income-generating capacity of the rural community, at the same time conserving the biodiversity of Philippines' indigenous vegetables. However, indigenous vegetable are being replaced by high yielding commercial varieties which are more proficient and preferred by most producers and consumers. Moreover, the lack of available germplasm for widespread use, lack of seeds, inadequate information on use and importance, lack of information about their performance and input requirements, and insufficient information on how indigenous vegetables can fit into production systems are hindrances for strengthening the food security.

Seed germination of these vegetables has a problem on its germination rate and dormancy. Unlike the cultivated species, seeds from wild species are generally dormant. For example, the germination of *Corchorus olitorious* exhibits seed dormancy which will result to low germination that adversely affecting field performance but limited research has been done on appropriate dormancy breaking methods. On the other hand, *C. olitorious* also known "Saluyot" in the Philippines, this plant can grow anywhere in the country and it is a hardy plant which resistant to pests and requires little care. Further, the leaves are very nutritious, it is rich in calcium, iron, protein, vitamin A, C and E, thiamin, riboflavin, niacin, folate, and dietary fibers. It is usually cooked as stew, forming thick slimy syrup similar in consistency to okra usually taken with rice or other starchy staple. However, the knowledge of cultivation, care and enhancing seed germination was limited.

The growth and yield of vegetable is remarkably influenced by organic and inorganic nutrients. It is well documented that the utilization of inorganic fertilizer, in contrast to organic one, is detrimental to human health and environment, mainly because of residual effects, and the excessive use of synthetic fertilizers may actually increase problems in the long run. There has been a trend towards decreasing the rates of inorganic fertilizer application to soils by using organic fertilizers more efficiently (Srivastava et al., 2012). In addition, organic products are in demand in the market due to health awareness and environmental impacts. Thus, the utilization of organic fertilizers have dual roles, increasing the productivity of soil as well as crop quality and yield.

Vermicompost tea is organic product obtain from vermitechnology. It is reported that the application of vermicompost tea was able to improve plant health, crop yield, and nutritive quality (Pant et al., 2009). In addition, it was been reported that soluble mineral nutrients, organic acids and water soluble plant-growth regulators extracted in the tea have a positive effects on initial root development and plant growth with both foliar and soil application (Keeling et al., 2003). Furthermore, its significantly stimulated seed germination in several plant species such as tomato plants (Atiyeh et al. 2000; Zaller 2007), petunia (Arancon et al. 2008) and pine trees (Lazcano et al., 2010).

Vermicompost tea has been proven to enhance the seed germination of several plant species. However, no reports have been done yet on the potential use of vermicompost tea as a seed germination enhancer for *C. olitorios* an indigenous vegetable in the Philippines. Hence, this will be a good avenue to use the potential benefits of vermicompost tea as germination enhancer for the common indigenous vegetables of the Philippines such as *C. olitorios* which will provide a high quality vegetables and relatively cost effective and safe alternative chemical for improvement of seed germination. This present investigation aims

1. To determine the effects of vermicompost tea in the seeds of *C. olitorios* as a seed germination enhancer;
2. To determine the correlation intercharacter parameters of *C. olitorios* and;
3. To identify treatments that can enhanced seed germination of *C. olitorios*.

2. METHODOLOGY

2.1. Preparation of Vermibed

Substrate was composed of cow manure, rice straw, kakawate leaves and chopped banana trunks were collected from the locality of Compostela, ComVal Province in a proportion ratio of 2:1:1:1 w/w. Vermicomposting was conducted on cemented earth surface. One vermibed was contructed with one meter wide and three meters length with the bed height of 1 foot. 15 days of anaerobic decomposition of substrate was done before the introduction of 2 kilograms of adult earthworms (*Eudrilus eugeniae*) in vermibed for aerobic decomposition for 40 days. The bed was covered with coconut leaves and moistens the beds daily up to 40 days for maintaining the moisture content. After seven days interval, mixture of bed was manually turned up to 3 weeks. After 30 to 40, days granular tea like vermicompost appear on the upper surface of beds. These final vermicompost with earthworms were used for the preparation of vermicompost tea.

2.2. Making of Vermicompost Tea and GA3 Solution

Vermicompost tea (VT) was prepared using two kilograms of vermicompost and 15 litres of non-chlorinated water and was placed in a container and brewed overnight. One kilogram of molasses was added after 24 hours to the container and brewed at least three days more. Gibberellic acid was prepared as a 1000 µg/ml stock solution. One gram of gibberellic acid was dissolved in litre of water. Gibberellic acid is insoluble in water and so it was first dissolved in 2 ml of ethyl alcohol and then made up to 1000 ml by adding distilled water to prepare a 1000µg/ml stock solution. 100 ml of stock solution was made up to 1 litre by using distilled water and this had a concentration of GA3 at 100µg/ml.

2.3. Treatment Application

Germination study was conducted at the Crop Science Laboratory of the Compostela Valley State College (CVSC) - Main Campus, Compostela, ComVal Province from January 2017 to April 2017. Experiment was arranged in a Complete Randomized Design (CRD) with 3 replications. The treatments are enumerated as follows:

T1 = Distilled Water
T2 = 10 % VT
T3 = 30 % VT
T4 = 50 % VT
T5 = 70 % VT
T6 = 90 % VT
T7 = 100 % VT
T8 = Gibberellic Acid

The seeds were grown in Petri dish and the treatments were given as mentioned above for all experimental plants. Comprising of five Petri dish were used for each of treatment and thus fifteen petri plates for each replication. The seeds of *C. olitorious* were soaked 24 hours according to the treatment description using a 500 ml beaker. Filter paper was soaked in 10 ml of chosen concentration of the vermicompost tea and placed in Petri dish. A control is set up with filter paper soaked in distilled water and GA3 solution was maintained for the purpose of comparison. Petri dish was kept at indoor laboratory conditions under diffused light.

2.4. Germination Parameters

For recording of observations, 10 seedlings of indigenous vegetables were randomly selected from each treatment per replication. Regular methods of recording data were used in taking the germination percentage, shoot length, and root length. The vigor index of the seedlings was determined by following the formula of Abdul-Baki and Anderson (1973). Vigor index = [mean of root length (cm) + mean of shoot length (cm)] × percentage of seed germinations.

2.5. Statistical Analysis

The different data gathered was analyzed through analysis of variance (ANOVA) and the differences among treatment means were compared using Tukey's Honest Significance Difference at 5% level of probability and germination parameters were correlated using Pearson correlation.

3. RESULTS AND DISCUSSION

Table 1 presents the germination response of *C. olitorius* at different concentration of vermicompost tea. Result shows that seed germination response of *C. olitorius* were affected by the vermicompost tea as a growth enhancer.

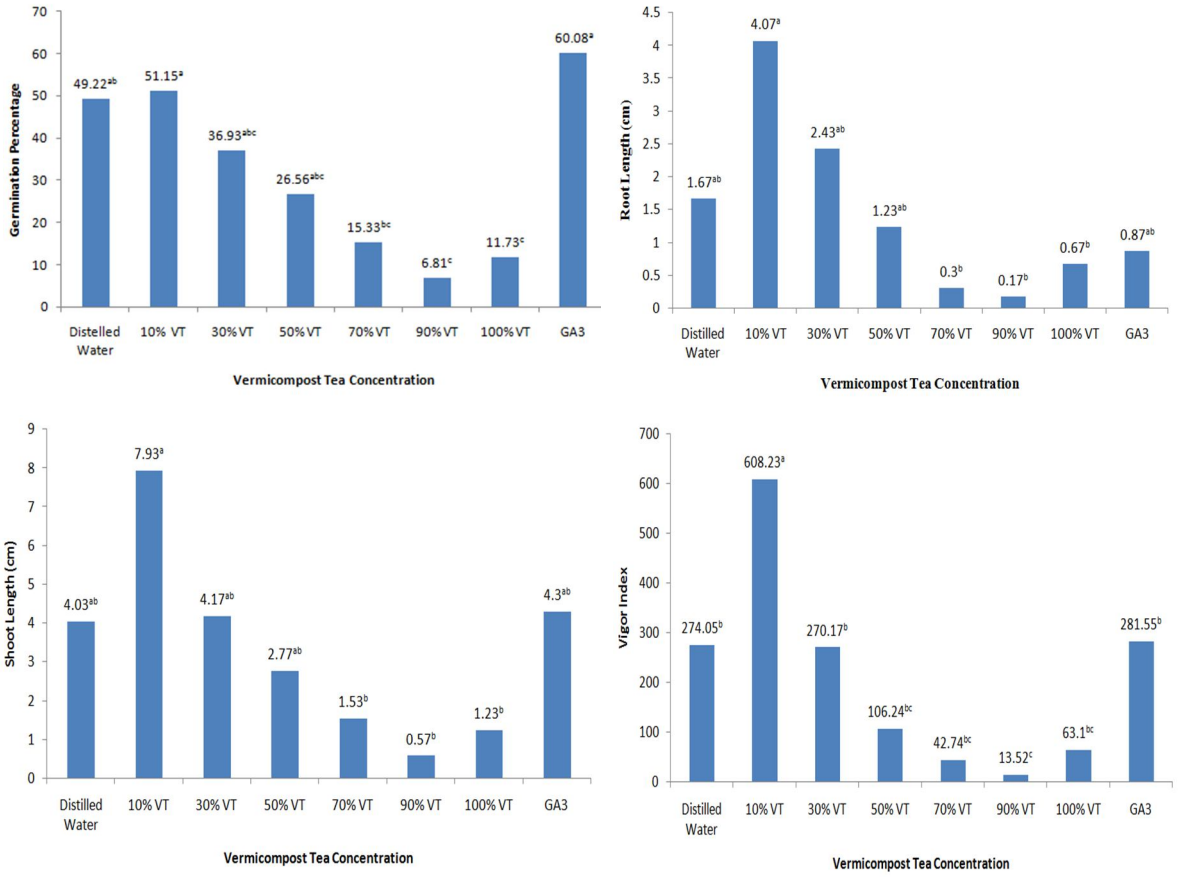
3.1. Germination Percentage

Different concentration of vermicompost tea solution as seed germination enhancer affects the germination percentage of *C. olitorios.* It shows that 10% of VT got the higher germination percentage to other treatment means, however, this result is comparable GA3 (Table 1). It implies that lower concentration of vermicompost tea has similar effects in GA3. This result is similar with findings of Arancon et al (2016) that lower concentaration of vermicompost tea able to increased seed germination. In addition, Lazcano et al. (2010) reported the positive effect of vermicompost and vermicompost extract on germination and early development of *Pinus pinaster*. Krishnamoorthy and Vajranabhiah (1986) reported the microbial activity in vermicompost could result in production of significant quantity of plant growth regulators such as IAA, gibberellins, cytokinins, by microorganisms. Large amount of humic acid were produced during vermicomposting and these had been reported to have positive effects on plant growth (Chen *et al.,* 1990; Atiyeh *et al*., 2002; Ramamoorthy, 2004).Thus, the application of vermicompost tea at lower concentration was able to increase the germination percentage of *C. olitorios* and has a comparable effect on GA3.

3.2. Root and Shoot Length

The longest root and shoot length of *C. olitorios* was observed in 10% VT (Table 1). This result may contribute to higher germination percentage of *C. olitorios* applied with lower concentration of VT. This result was similar with findings of Golchin et al (2006) that vermi tea exhibited growth promoting effects on the exomorphological characters such as plant height and length of shoot. In addition, vermicompost tea was able to supply balanced nutrients to plant roots and stimulate growth; increase organic matter content of the compost including the 'humic substances' that affect nutrient accumulation and promote root growth (Canellas et al., 2002). Root initiation, increased root biomass, enhanced plant growth and development and sometimes, alterations in plant morphology are among the most frequently claimed effects of vermicompost treatment (Tomati et al., 1988). Thus, 10% of vermicompost tea was able to improve the root and shoot length of *C. olitorius*. However, it was observed that higher concentration of VT was not able to improve the germination response of *C. olitorios.* This result support the findings by Arancon et al. (2006) who reported that the effects of the application of humic acids on plants, in which growth of marigolds decreased when grown in a soilless media that contained a combination of 10 µM IAA and 500 $mg \cdot kg^{-1}$ humic acids from food waste vermicomposts.

Table 1. Germination response of *C. olitorius* using different concentration of vermicompost tea



3.3. Vigor Index

Result shows that the lower concentration of VT obtained the highest vigor index among treatments which indicates that application of 10% VT promotes healthy and vigorous seedling response to other VT concentration (Table 1). This result shows that vermicompost tea could promote early and vigorous growth of seedlings. Thus, lower concentration of VT was able to produced healthy and vigorous seedling for seedling establishment in the field.

3.4. Intercharacter Correlation

Pearson correlation was calculated between germination parameters of *C. olitorios* applied with different concentration of vermicompost tea (Table 2). Result shows that vigor index was positively and significantly correlated with the root and shoot length and germination percentage. Thus, seedlings with higher vigor index has a longer of root and shoot length and higher germination percentage which means that seedlings are healthier and vigorous for seedling establishment in the field.

Table 2. Correlation matrix of germination parameters of *C. olitorius* using different concentration of vermicompost tea

	Germination Percentage	Root Length	Shoot Length	Vigor Index
Germination Percentage	1			
Root Length	.607	1		
Shoot Length	.841**	.920**	1	
Vigor Index	.807*	.926**	.989**	1

***- Correlation is significant at the 0.01 level (2-tailed), *- Correlation is signifycant at the 0.05 level (2-tailed)*

4. CONCLUSION

Results demonstrated that lower concentration of VT able to promote and enhance germination parameters of *C. olitorius*. Thus, it shows that lower rates of VT usually promote plant growth; however, higher application rates can depress plant growth. Thus, lower concentration of VT promotes seed germination enhancement of *C. olitorius.* In addition, seedlings with higher vigor index has a longer of root and shoot length and higher germination percentage which means that seedlings are healthier and vigorous for seedling establishment in the field.

5. RECOMMENDATION

The present investigation recommend in exploring the effects of VT in physiological level of plant that will contribute to higher germination rating and vigor index and to try the different concentration of VT as a seed germination enhancer to other indigenous vegetables and high valued crops.

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