International Journal of Minor Fruits, Medicinal and Aromatic Plants. Vol. 6 (2) : 96-101, December 2020

SHORT COMMUNICATION

Impact of organic application for controlling damping-off in tomato (*Solanum lycopersicum*)

S. L. Nawarathna[1]*, P. I. Yapa[2] and N. P. Vidanapathirana[1]

[1]Department of Agro-technology, Institute for Agro-technology and Rural Sciences, University of Colombo, Sri Lanka

[2]Faculty of Agriculture Science, Sabaragamuwa University of Sri Lanka

**Email: supipi.ln@gmail.com*

Received : 20.12.19 ; Revised : 08.04.20 Accepted : 12.04.20

ABSTRACT

Tomato (Solanum lycopersicum) cultivation in across the globe has expanded as a cash crop for commercial production. Among various soil borne diseases, damping-off is severely affected nursery stage. During the past, farmers have relied strictly on fungicides for its management. Now, however, the public's increasing concern for environmental health makes alternative management strategies more desirable. Therefore investigation of organic method for controlling damping-off of tomato in nursery stage is a current need. Meanwhile the cultivation organically is another issue due to absent of proper method to control diseases in nursery stage. By use of vermin-wash, jeewamurthum and bio-char independently, it is possible to resolve the issue and it provides new alternatives and economic opportunities for disease management in vegetable production. The result revealed that organic applications were controlled damping-off and vermin-wash promoted the seed germination and growth parameters such as seedling height, root volume. Jeewamurthum enhanced the cumulative leaf number of seedling and controlling of the damping-off.

***Keywords*:** Bio-char, damping-off, jeewamurthum, nursery, vermi wash

INTRODUCTION

Tomato (Solanum lycopersicum) is economically important crop in Sri Lanka used as a vegetable as well as a fruit (Wahundeniya *et al*., 2006). Ripe tomato fruits are used as salad universally as because it is excellent source of health-promoting compounds of minerals and antioxidants including vitamins C and E, lycopene, β-carotene, lutein, etc. Due to ill-effect of inorganic fertilizers, insecticides and fungicides, organic cultivation of vegetables is gaining importance (Prasad *et al*., 2019). Tomatoes are normally transplanted because much better results are gained when seedlings are raised in a nursery. Smaller quantities of seeds are needed, the seedlings can be selected for growth and health before planting in the field, the plantlets can be well protected and the planting distance is more regular than after sowing directly in the field (Shankara *et al*, 2005).

Damping off of seedlings is a common disease all over the world. It occurs in agricultural and forest soils, in tropical and temperate climates and in almost every greenhouse environment (Rasanjalie and Ranaweera, 2009). Damping-off which is attributed to the attacks of various fungi, occurs in the nursery stage (Paul, 1936). Generally fungi like Pythium, Phytophthora, Sclerotinia, Thielavia,Glomerella, Fusarium, Rhizoctonia, Phoma and Ozoniumare responsible for such diseases and they can cause the disease either as a single pathogen species or as group of pathogen species (Rasanjalie and Ranaweera, 2009). Meanwhile, species of Botrytis, Cylindrocladium and Diplodia have also been found associated with damping off diseases (Bilgrami and Dube, 2000). According to the Ruvimbo *et al.* (2016) that species of the soil organism Pythium are more often responsible for damping- off. According to the symptoms of this disease, seeds may rot before germinating. Seedlings may decay before emergence, giving the appearance of poor germination. Damping-off also affects the stem base of seedlings, resulting in dark, water-soaked, soft lesions. Seedlings wilt and fall over (Adeltruda *et al.*, 2012).

As a result of damping off, The use of chemicals has been the most widely used control strategy but due to their negative effects on the environment

and human health, there is need to come up with alternative approaches that are environmentally friendly (Ruvimbo *et al.,* 2016). In this study an attempt was made to test the feasibility of organic applications against damping-off of tomato seedling and growth performance of seedlings in the nursery stage.

MATERIAL AND METHODS

The experiment was conducted at the institute for Agro-technology and Rural Sciences (UCIARS), Weligatta under shade house condition. The five treatments and twenty replicates were arranged in a complete randomized design and tomato (*Lycopersicon esculentum* L.) var. Thilina was selected based on the recommendation of the Department of Agriculture, Sri Lanka (Department of Agriculture, 2016). Experiment was repeated two times. The treatments were recommended nursery medium (Department of Agriculture, 2016) with captan as inorganic fungicide (T1), recommended nursery medium with jeewamurthum(T2), recommended nursery medium with vermi -wash (T3), in equal parts of recommended nursery medium with bio-char (T4) and recommended nursery medium (T5).

Preparation of Jeewamurthum

A traditional organic fertilizer which is used in organic agriculture. Based on Unni (2016) that 1L of jeewamurthum was prepared by adding 100g of cow dung, 200g of sugar, 100g of semi dried gliricidia leaves, 2 tb spn of soi from undisturbed area (forest etc.) with 1L of water. The ingredients are mixed 3 times daily and allowed to ferment for 7 days.

Preparation of Vermi wash

Vermiwash was prepared based on Kumar (2005) that a one side open plastic barrel with an outlet tap at the bottom was used. The barrel was filled to a height of 25 cm with broken bricks, above which was placed a 30 cm layer of coarse sand and decomposed compost (30 cm - 45 cm). Then fresh green leaves were added. This was gently moistened with water and into this were introduced 50 earthworms belonging to the species Eisenia fetida. The unit was moistened every day and after sixteen days eluates were collected.

Preparation of bio-char

According to Granatstein *et al.* (2009) that bio-char was produced as results from pyrolysis, a thermochemical conversion process for biomass materials. Bio-char was made from the pyrolysis of neem wood bark at 600-7000C (Uchimiya *et al*., 2011a) for 4hrs (Copley *et al.*, 2015).

Nursery preparation

The nursery was established in styrofoam trays inside the shade house. Well decomposed farm yard manure and fine sand at the ratio of 1:1 were used as nursery medium (Department of Agriculture, 2016). The media was used for T1, T2, T3 and T5 and treatments were applied as soil application before 12hr of seed planting. Biochar was ground and used at ratio of 1:1 with nursery medium for T4. Seed viability test by floatation method was performed and non-viable seeds were discarded. The media were each replicate 20 times and in each replicate two viable seeds were planted at 5mm depth. Watering was done at daily and weeding was practiced manually.

Plant growth parameters and damping-off infection.

Seedlings emergence were counted daily. Vegetative growth parameters measured weekly included plant height (cm), leaf number per plant and root volume per plant. Damping-off disease infection was determined in weekly.

RESULTS AND DISCUSSION

Seedlings emergence

Time taken for seedling emergence was found to be significantly affected by the treatments. The percentage of emergence was generally high. The survival percentage of seedlings was varying among treatments. The least time taken for seedling emergence was significantly recorded in the vermin- wash applied medium and captan applied nursery medium (Figure 1).

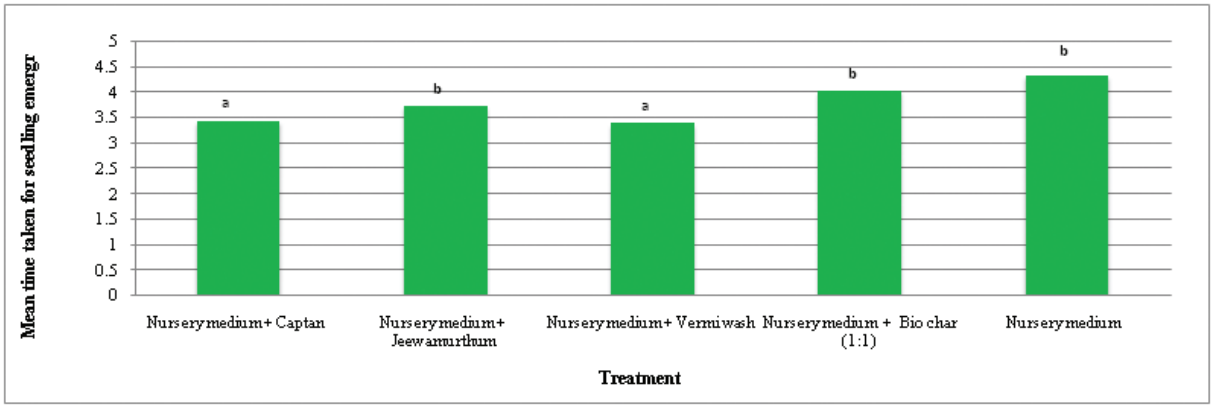

Fig. 1: **Effect of application on time taken for seedlings emerge of (*Lycopersicon esculentum* L.) *var.* Thilina after 7 days.**
Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

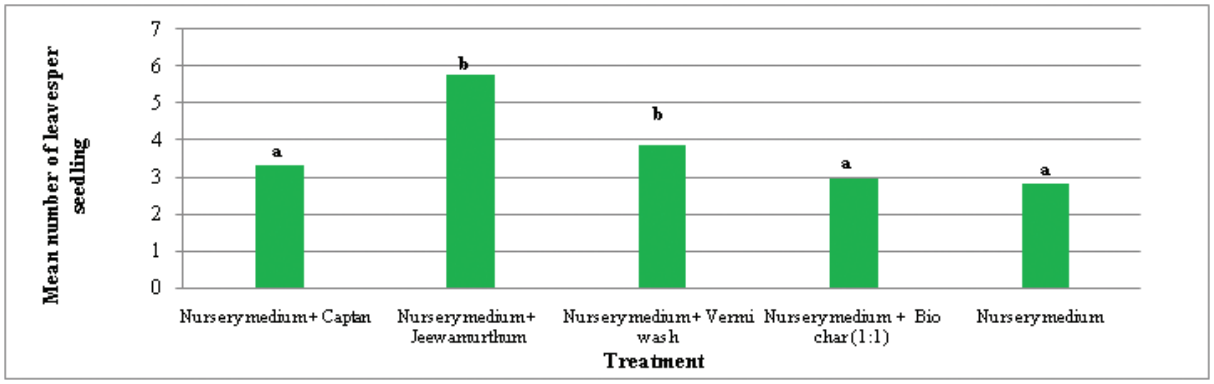

Fig. 2: **Effect of application on mean number of leaves per seedling of (*Lycopersicon esculentum* L.) *var.* Thilina after 4 weeks.**
Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

Incidence of damping-off percentage

There was a significant difference among treatments for disease incidence; Jeewamurthum, vermi wash and bio char applied nursery medium did not show any damping-off indicated that those treatments were influence significantly on media for disease suppression (Table 1).

Cumulative leaf number

Mean leaf numbers of seedlings were significantly increased in jeewamurthum and vermi wash applied media among treatments. As reported by Unni (2016) jeewamurthum was a microbial medium with rich of major and minor nutrients. It was rich in favorable microorganisms which was

Table 1: Damping-off disease infected seedlings

Treatment	Mean damping-off disease infected seedlings
Nursery medium + Captan (T1)	0.13[b]
Nursery medium + Jeewamurthum (T2)	0.00[a]
Nursery medium + Vermi wash (T3)	0.00[a]
Nursery medium 1 + Bio char 1 (T4)	0.00[a]
Nursery medium (T5)	0.28[b]

Mean followed by the same letters are not significantly different at P=0.05 probability level

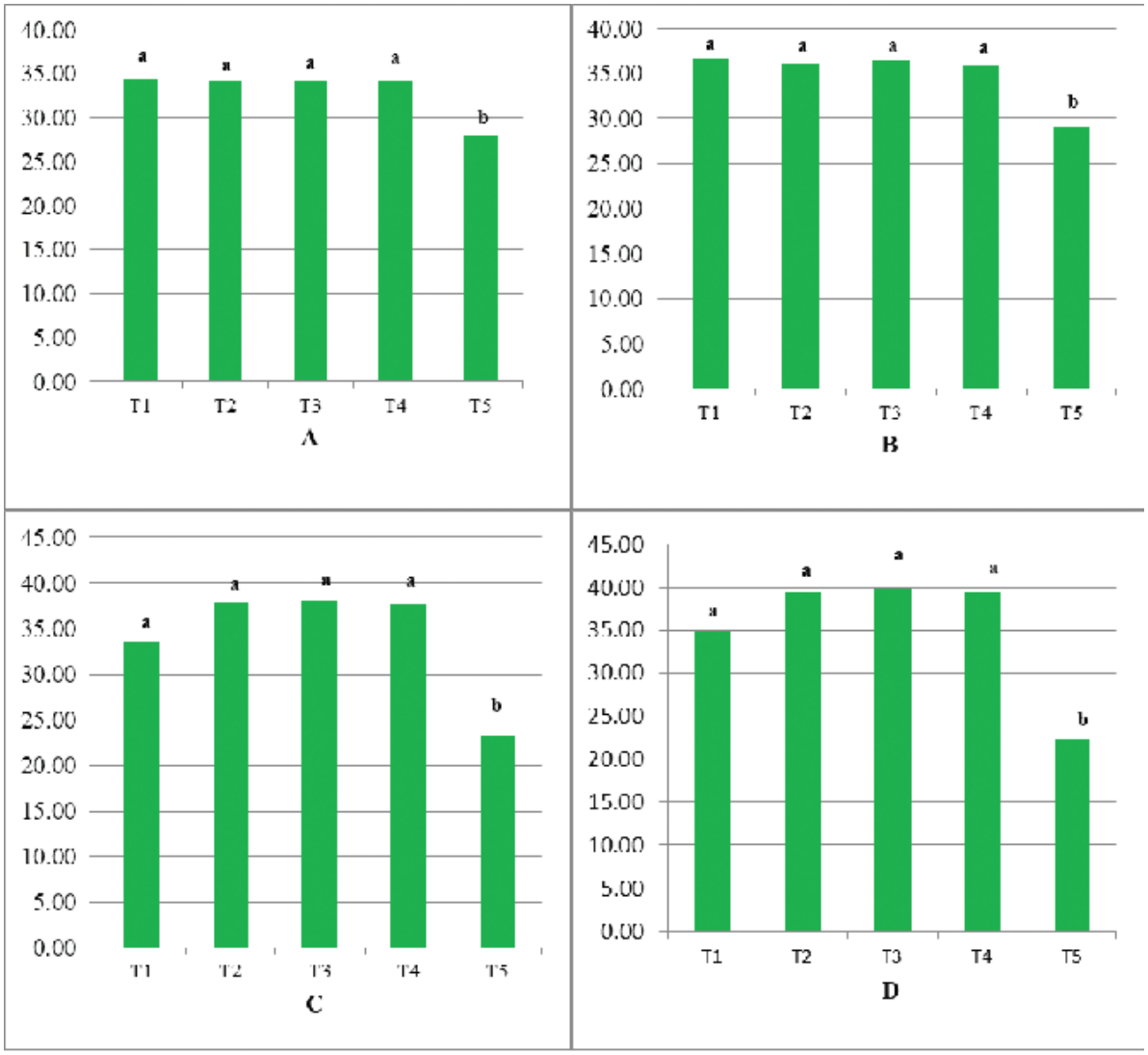

Fig. 3: Effect of application on mean seedling height of (*Lycopersicon esculentum* L.) *var.* Thilina (A) after a week, (B) after 2 weeks, (C) after 3 weeks and (D) after 4 weeks of planting. (T1- recommended nursery medium with captan inorganic fungicide; T2- recommended nursery medium with jeewamurthum; T3- recommended nursery medium with vermi wash; T4- in equal parts of recommended nursery medium with bio-char; T5- recommended nursery medium).
Means on the bars represent the same letters are not significantly different at $P \leq 0.05$ probability level.

help to induced plant growth by accumulation of nutrient for the medium (Figure 02). Available nutrient content of the nursery medium was limited and it was not sufficient to fulfill the demand with the growth of the seedling. Growth performance of seedling was retarded with dilution of available nutrient of the medium.

Seedling height

Seedling height was differed significantly among the treatments at 1week, 2weeks, 3weeks and 4weeks after planting in the nursery. The highest seedling height was recorded significantly in recommended nursery medium with captan inorganic fungicide, recommended nursery medium with jeewamurthum, recommended nursery medium with vermi wash and in equal parts of recommended nursery medium with bio-char (Figure 03). As reported by Kaur *et al.* (2015) vermin- wash caused to growth promoting effects on plant height, length, number of leaves and root length etc. exo-morphological characters of the

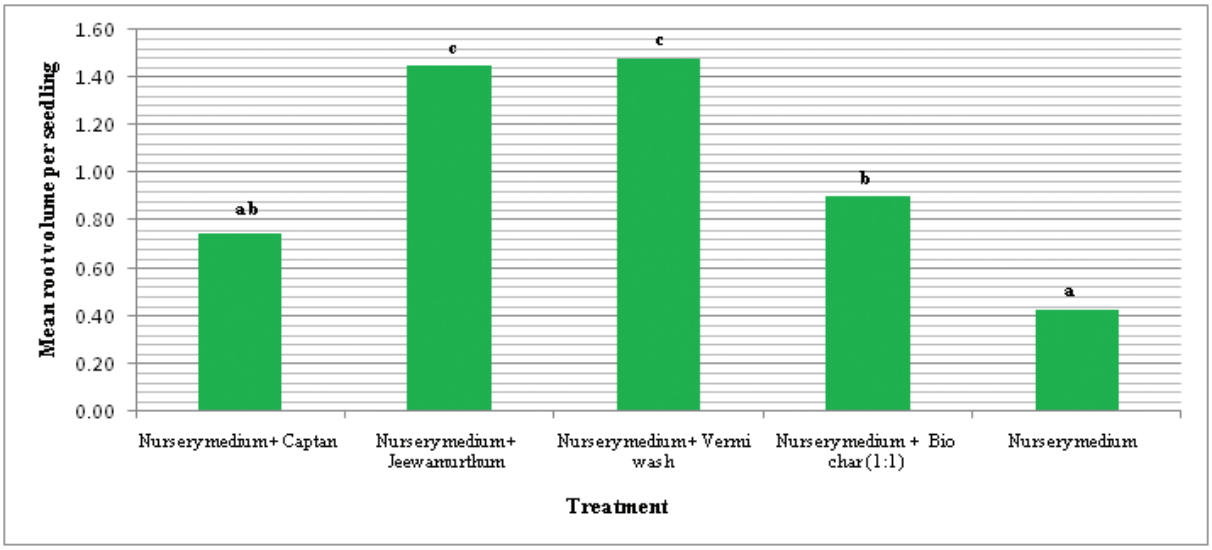

Fig. 4: Effect of application on mean root volume per seedling of (*Lycopersicon esculentum* L.) *var.* Thilina after 4 weeks.
Means on the bars represent the same letters are not significantly different at P ≤ 0.05 probability level.

plant. Mean height of the seedlings of captan applied medium and nursery medium without any application were dropped with the time period due to the susceptibility for damping-off disease.

Root volume

Root volumes of seedlings were significantly increased in recommended nursery medium with jeewamurthum and recommended nursery medium with vermi wash among treatments (Figure 4).

CONCLUSION

With the global trend moving towards the production of organic food crops, in the present study can be suggested that vermi wash, jeewamurthum and bio char can be used to control damping-off in the nursery stage of tomato and those organic applications will supply nutrients and other soil stimulants for seedling growth.

REFERENCES :

Adeltruda Massawe, MansuetTilya, Martin Kimani, Richard Musebe and ElisianaKweka 2012. Damping off disease management in tomatoes - fact sheets for farmers, Plant wise, Horti Tengeru, Tanzania.

Arvind Kumar, 2005. Verms and vermi technology, 1sted, A.P.H. Publishing Corporation, New Delhi. Pp.101-104.

Bilgrami, K.S. and Dube, H.C. 2000. Rots and damping off. A text Book of Modern Plant Pathology, pp.179-181.

Copley, Tanya R., Konstantinos A. Aliferis and SuhaJabji 2015. Maple bark biochar affects Rhizoctonia solani metabolism and increases damping-off severity. Phytopathology, *The American Phytopathological Society*, **105** (10): 1335.

David Granatstein, Chad Kruger, Manuel Garcia perez, Jonathan Yoder and Suzette Galinato 2009. Biochar and Pyrolysis: Renewable Soil Carbon and Energy, Sustaining the Pacific Northwest, Vol.7, No.4, Pp.1.

Department of Agriculture, 2016. Tomato - Solanum lycopersicum., http://www.doa.gov.lk/HORDI/index.php/en/crop-2/37-tomatoes-e

Kaur P, Bhardwaj M and Babbar I. 2015. Effect of vermi compost and vermi wash on growth of vegetables. *Research journal of Animal, Veterinary and Fishery Sciences*, **3**(4): 9-12.

Paul, W.R.C. 1936. Tomato Cultivation in the Dry Zone of Ceylon-IV, *The tropical Agriculturist*, **2**: 34-43.

Prasad, G., Tarai, R.K., Sethy, B.K. and Nandi, A. 2019. Studies on the effect of organic and integrated sources of nutrients on yield and economics of Bottle Gourd. *International*

Journal of Minor Fruits, Medicinal and Aromatic Plants, **5**(2): 39-44.

Rasanjalie, N.W.M. and Ranaweera, B. 2009. Effect of Trichoderma viride on damping off and growth of tomato (Lycopersicon esculentum) seedlings raised in coco-peat pellets and potting mixture, 9th Agricultural Research Symposium, Sri Lanka, pp. 357-362.

Ruvimbo MajorieMudyiwa, Paul Chaibva, Marjory Takawira and Primrose Njeni. 2016. Evaluation of Trichoderma harzianum in controlling damping-off (Pythium spps) on tomato (Solanum lycopersicum) seedling varieties, *Annals of Biological Research*, **7** (6): 6-11.

Shankara Naika, Joep van Lidt de Jeude, Marja de Goffau, Martin Hilmi and Barbara van Dam. 2005. Cultivation of Tomato, Agromisa Foundation and CTA, Wageningen, pp.13

Uchimiya, M., Chang, S., Klasson, KT. 2011a. Screening biochars for heavy metal retention in soil: role of oxygen functional groups. *J Hazard Mater*, **190**:432-441.

Unni R. 2016. "JEEVAMRUTHAM" The Elixir For Modern Day Agriculture, http://creative.sulekha.com/jeevamrutham-the-elixir-for-modern-day-agriculture_629589_blog

Wahundeniya W.M.K.B, Ramanan R, Wickramathunga C and Weerakkodi W.A.P. 2006. Comparison of growth and yield performance of tomato (Lycopersicon esculentum mill.) varieties under controlled environment conditions, Horticulture crop research and development institute, Gonnaruwa, Peradeniya, Sri Lanka, Pp. 2.