

Influence of different pre-sowing treatments on seed germination and seedling characteristics of Bitter Gourd (*Momordica charantia* L.), Bottle Gourd (*Lagenaria siceraria*) and Ridge Gourd (*Luffa acutangula*)

ABSTRACT

In order to study the influence of different pre-sowing treatments on seed germination and seedling characteristics of bitter gourd cv. Co-1, bottle gourd cv. Pusa Summer Prolific Long and ridge gourd cv. Arka Sumeet an experiment was conducted at Horticulture orchard, Department of Horticulture, Annamalai University during *zaid* season 2022. Three cucurbits were soaked in various treatments along with control to determine the best treatment. The results indicated that the treatments T₄- GA₃ @ 200 ppm with 24 hours T₅-100% Coconut water @ 24 hours and T₆-3% Panchagavya @ 24 hours of soaking have shown the highly significant compared to the T₁- control and enhanced the germination percentage, shoot length, root length, seedling length and vigour index on all the three cucurbits.

Keywords: Gibberellic acid, Panchagavya, Seed germination, Phytohormones

INTRODUCTION

The Cucurbitaceae is a notable plant family, justifiable of attention because of its economic, aesthetic, cultural, medicinal and botanical importance (Lebeda *et al.*, 2007). India is blessed with a rich diversity of cucurbits and is believable to be the primary and secondary centres of origin of many groups of crops under the family *Cucurbitaceae*. Among various gourds, bitter gourd, bottle gourd and ridge gourd are one of the major cucurbitaceous vegetables and fruits. It has been identified as one of the promising vegetable crop for export by Agricultural Processed Products for Export and Development Authority (APEDA) (Thangamani, 2011). Cucurbits have a problem of emergence and even with the seeds of high germinability due to thick seed coats. To overcome this problem, pre-sowing treatments soaking or priming of seeds can be practice. Pre-germinated seeds proved superior in the emergence and in stand establishment (Nawaz *et al.*, 2013). The additional advantages of this treatment include lower seed rate, dead seeds can be discarded before sowing and germinating, but low vigour seeds can be removed before sowing (Rahman *et al.*, 2021).

A plant hormone called Gibberellic acid (GA₃) plays a very important function in plant growth and development like seed germination, stem elongation and flower development. Different kinds of stimuli such as developmental, environmental and hormonal regulated GA₃ biosynthesis. Soaking the seeds with suitable concentrations of GA₃ have positive effect on germination, growth and producing various plant varieties (Ayaz *et al.*, 2019). Panchagavya having enriched with the essential macro and micro nutrients favours for the growth of the crop under biotic and abiotic stress conditions (Patil *et al.*, 2021). Coconut (*Cocos nucifera* L.) is an important fruit tree. Coconut water (coconut liquid endosperm) have many applications and consumed worldwide as it is nutritious and beneficial for health. Some of the most significant and useful components in coconut water are cytokinins (kinetin and *trans*-zeatin) which are a class of phytohormones, indole-3-acetic acid (IAA), the primary auxin in

plants and other components like sugars, sugar alcohols, lipids, amino acids, nitrogenous compounds, organic acids and enzymes and they play different functional roles in plant and human systems due to their distinct chemical properties (Dunsin *et al.*, 2016). Milk is considered as better pre-sowing treatment or priming agent than that of water. Fresh cow milk had 0.012 µg mL⁻¹ for IAA and IBA. The good performance of fresh cow milk in breaking the dormancy in bitter gourd seeds could be attributed to the presence of hormones such as IAA and ABA (Adelani and Maisamari, 2016).

MATERIALS AND METHODS

The present investigation was carried out in Horticulture orchard, Department of Horticulture, Annamalai University, Chidambaram, Tamilnadu during *zaid* season in 2022. The experiment was laid out in Completely Randomized Design (CRD) with three different cucurbits *i. e.*, Bitter gourd cv. Co-1 (*Momordica charantia* L.), Bottle gourd cv. Pusa Summer Prolific Long (*Lagenaria siceraria*) and Ridge gourd cv. Arka Sumeet (*Luffa acutangula*). The details of experimental techniques, materials and method adopted for the study are presented in this chapter.

The experimental material comprised of eight different treatments *viz.*, T₁-Control, T₂-Tap water @ 24 hours, T₃-GA₃ @ 100 ppm with 24 hours of soaking, T₄- GA₃ @ 200 ppm with 24 hours of soaking, T₅-100% Coconut water @ 24 hours of soaking, T₆-3% Panchagavya @ 24 hours of soaking, T₇-100% Fresh Milk @ 24 hours of soaking and T₈-Azospirillum @ 24 hours. Observations were recorded in five randomly chosen plants in each replication for germination percentage, shoot length, root length, seedling length and vigour index. Germination percentage were recorded by dividing the number of germinated seeds on total seed sown. The formula is as under:

$$\text{Germination percentage} = \frac{\text{Number of germinated seeds}}{\text{Number of total seed sown}} \times 100$$

Vigour index was calculated on the basis of mean seedling length and mean seedling dry weight by adopting the formula. Seedling vigour index = Germination (%) x Mean seedling length (cm) divided by 100 (Adebisi, 2004).

METHODOLOGY

Control: The seeds are not soaked in any treatment were considered as control.

Tap water: The seeds were soaked in the normal tap water for 24 hours.

GA₃ 100 ppm: The concentration of gibberellic acid 100 ppm was prepared by dissolving 100 mg of GA₃ in a little quantity of ethyl alcohol solution and volume was make up to 1000 ml with distilled water to get 100 ppm solution. The seeds were soaked in such solution for 24 hours under the room temperature.

GA₃ 200 ppm: The concentration of gibberellic acid 200 ppm was prepared by dissolving 200 mg of GA₃ in a little quantity of ethyl alcohol solution and volume was make up to 1000 ml with distilled water to get 200 ppm solution. The seeds were soaked in such solution for 24 hours under the room temperature.

Soaking of seeds in Coconut water: Tender coconut were brought from farm, extracted the coconut water. Soaked the seeds in 100% coconut water for 24 hours duration without any addition of water. Later the seeds were dried under shade and used for sowing.

Soaking of seeds in Panchagavya solution: Panchagavya, it is a fermented product literally prepared from five products of a cow viz., milk, urine, dung, curd and ghee. These ingredients are placed in a pot and mixed twice daily to enhance the microbial activity, on the 15th day the enriched product panchagavya is made. To prepare 3% solution; 30 ml of fermented panchagavya was taken in beaker and then 1000 ml distilled water was added with constant stirring to get mixed up properly. After preparation, seeds of bitter gourd, bottle gourd and ridge gourd were soaked in required solution for 24 hours at room temperature. After 24 hours of soaking the solution drained out from beaker and pre-soaked were air dried to original weight and then placed for germination in laboratory under controlled condition (Patil *et al.*, 2021).

Soaking of seeds in milk: The seeds were soaked in freshly milched cow milk. And the seeds were soaked in 100% cow milk for 24 hours duration. Later the seeds were dried under shade and used for sowing.

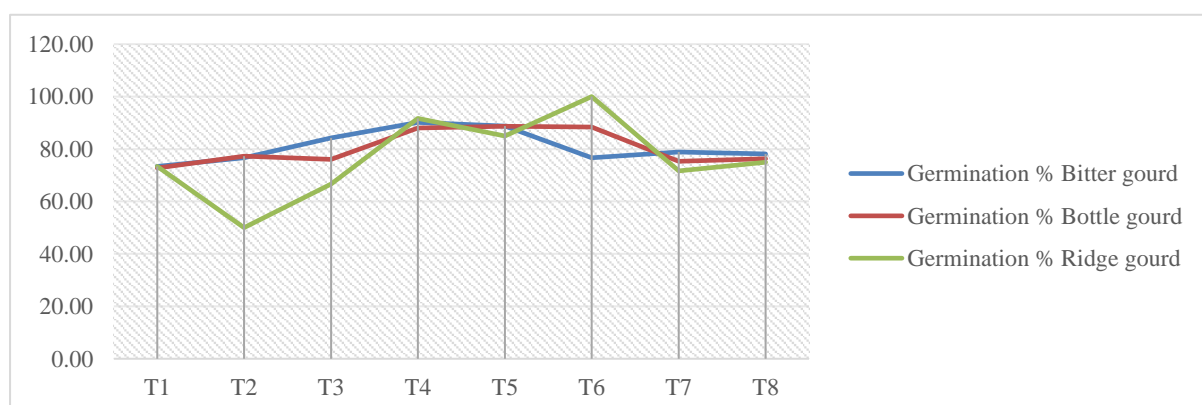
Seeds soaking in Azospirillum: Azospirillum is a biofertilizer, 100 gm of azospirillum is mixed with cooked rice water to make semi liquid. Then the seeds were soaked for 24 hours under the room temperature to have uniform coating of the inoculants over the seeds. Treated seeds were shade dried for 20 minutes and used for sowing.

RESULTS

The germination capacity of a seed is based on dual response (germinated/ non-germinated), is one qualitative attribute of the germination process generally converted in a quantitative attribute, commonly in percentage. The results shown in (Table 1) that there are significant differences (at 5% level) between effective treatments on germination traits and other treatments resulted in significant differences among various parameters.

Germination Percentage

In this research, the results shown that the germination percentage of bitter gourd increased due to the application of different pre-sowing treatments. According to the attained results, treatment (T₄) GA₃ @ 200 ppm with 24 hours of soaking (90.15) soaking duration which is shown highest significant among all treatments of seed germination, followed by (T₅) 100% Coconut water @ 24 hours of soaking (88.74) and (T₃) GA₃ @ 100 ppm with 24 hours of soaking (84.19). In bottle gourd, the maximum number of normal seedlings found in the treatment (T₅) 100% Coconut water @ 24 hours of soaking (88.67) followed by (T₆) 3% Panchagavya @ 24 hours of soaking (88.33) and (T₄) GA₃ @ 200 ppm with 24 hours of



soaking (88.00). In ridge gourd, the treatment (T₆) 3% Panchagavya @ 24 hours of soaking (100) shown highest germination percentage followed by (T₄) GA₃ @ 200 ppm with 24 hours of soaking (91.67) and (T₅) 100% Coconut water @ 24 hours of soaking (85).

Fig: 1 Germination percentage of Bitter gourd, Bottle gourd and Ridge gourd under various treatments

Shoot Length (cm)

The maximum shoot length of (11.84) was shown by treatment (T₅) 100% Coconut water @ 24 hours of soaking followed by (T₄) GA₃ @ 200 ppm with 24 hours soaking (11.40) and (T₆) 3% Panchagavya @ 24 hours of soaking (11.08) in bitter gourd. In bottle gourd, the maximum shoot length can observe in (T₄) GA₃ @ 200 ppm with 24 hours soaking (14.87) followed by (T₁) Control (14.03) and (T₆) 3% Panchagavya @ 24 hours of soaking (13.80). And in ridge gourd, the maximum shoot length shown in the treatment (T₆) 3% Panchagavya @ 24 hours of soaking (13.90) followed by (T₅) 100% Coconut water @ 24 hours of soaking (13.07) and (T₃) GA₃ @ 100 ppm with 24 hours of soaking (12.97).



Fig: 2 Shoot length of Bitter gourd, Bottle gourd and Ridge gourd under various treatments

Root Length (cm)

Among the treatments, the treatment (T₆) 3% Panchagavya @ 24 hours of soaking (5.52) shown the significant highest followed by (T₅) 100% Coconut water @ 24 hours (5.07) and (T₄) GA₃ @ 200 ppm with 24 hours of soaking (5.00) in bitter gourd. In bottle gourd, the maximum root length observed in the treatment (T₄) GA₃ @ 200 ppm with 24 hours of soaking (11.17) followed by (T₅) 100% Coconut water @ 24 hours of soaking (10.73) and (T₆) 3% Panchagavya @ 24 hours of soaking (10.33). In ridge gourd, the treatment (T₆) 3% Panchagavya @ 24 hours of soaking (9.13) shown significant highest of root length among all treatments at par with (T₂) Tap water @ 24 hours (9.13) followed by (T₅) 100% Coconut water @ 24 hours of soaking (8.93).

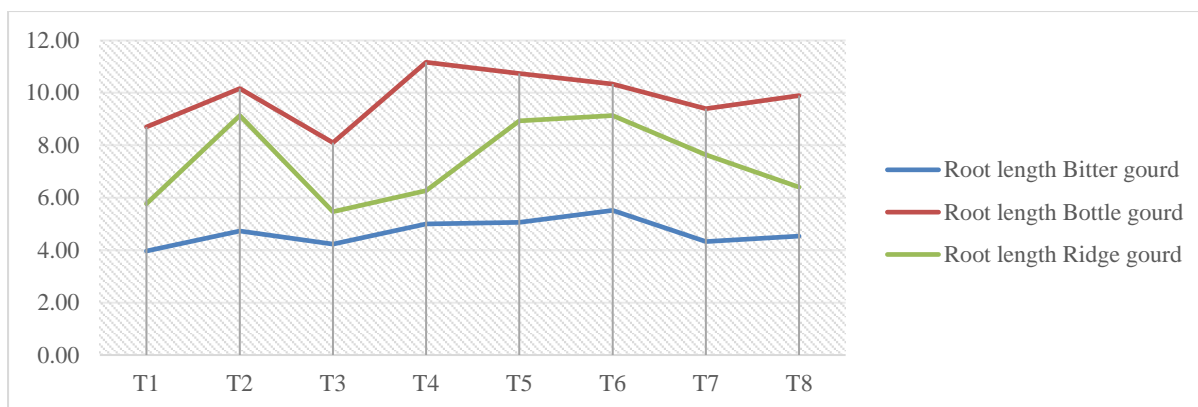


Fig: 3 Root length of Bitter gourd, Bottle gourd and Ridge gourd under various treatments

Seedling Length (cm)

The effect of pre-sowing treatment on seedling length of bitter gourd, bottle gourd and ridge gourd. From the data, it was concluded that (T₅) 100% Coconut water @ 24 hours of

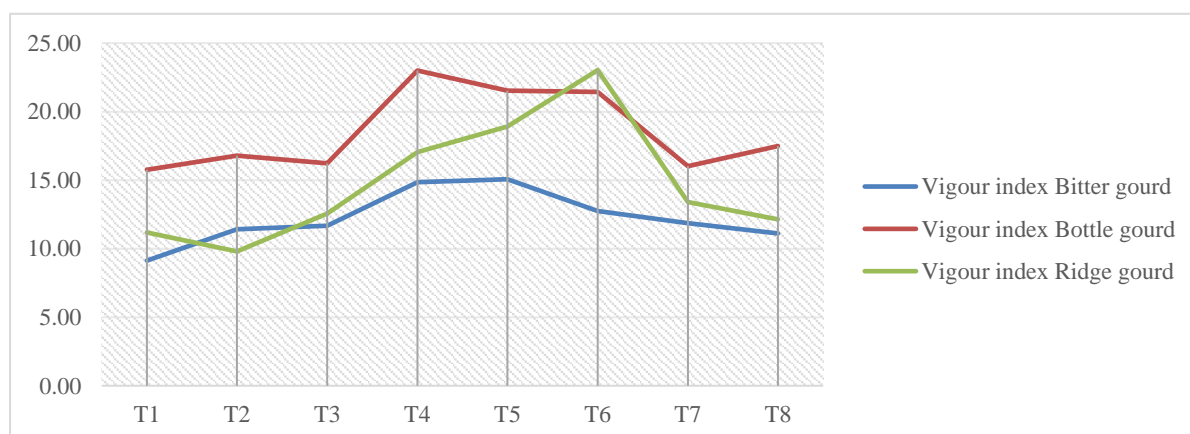


soaking (16.91) is at par with (T₆) 3% Panchagavya @ 24 hours of soaking (16.60) and (T₄) GA3 @ 200 ppm with 24 hours of soaking (16.40) in bitter gourd. In bottle gourd, the treatment (T₄) GA3 @ 200 ppm with 24 hours of soaking (26.03) shown significantly highest, followed by (T₆) 3% Panchagavya @ 24 hours of soaking (24.13) and (T₅) 100% Coconut water @ 24 hours of soaking (24.07). In ridge gourd, the maximum seedling length shown in the treatment (T₆) 3% Panchagavya @ 24 hours of soaking (23.03) followed by (T₅) 100% Coconut water @ 24 hours of soaking (22.00) and (T₃) GA3 @ 100 ppm with 24 hours of soaking (18.43).

Fig: 4 Seedling length of Bitter gourd, Bottle gourd and Ridge gourd under various treatments

Vigour Index

Pre-sowing treatment with (T₅) 100% Coconut water @ 24 hours of soaking (15.07)



were shown significantly highest vigour index in bitter gourd followed by (T₄) GA₃@ 200 ppm with 24 hours of soaking (14.84) and (T₆) Panchagavya @ 24 hours of soaking (12.75). In bottle gourd, significantly highest vigour index shown in treatment (T₄) GA₃ @ 200 ppm with 24 hours of soaking (23.00) followed by (T₅) 100% Coconut water @ 24 hours of soaking (21.53) and (T₆) 3% Panchagavya @ 24 hours of soaking (21.43). In ridge gourd, the treatment (T₆) Panchagavya @ 24 hours of soaking (23.03) were shown significantly highest vigour index followed by (T₅) 100% Coconut water @ 24 hours of soaking (18.91) and (T₄) GA₃ @ 200 ppm with 24 hours of soaking (17.05).

Fig: 5 Vigour index of Bitter gourd, Bottle gourd and Ridge gourd under various treatments

DISCUSSION

Pre-sowing seed treatments are where seeds were exposed to an external water potential low enough to hamper germination by various treatments like PEG, inorganic salts, hydration,. So it allows pre-germinative physiology and biochemical activities (Mavi *et al.*, 2006). Pre-sowing seeds significantly regulates the different types of seed dormancy as well as improves the vigourity. Thus, various pre-sowing treatment can be potentially used in crop production to increase the uniformity of germination along with better growth and developments (Rao *et al.*, 2019). It prevents the seed germination by arresting the embryo growth. Normally, dormancy level is strongly influenced by different developmental phases and interaction with environmental external factors experienced by the mother plant. It may bring certain alternation in bio-chemical process, catalyze enzyme activities, cytokines content changes, water absorption capacity of seed and it is inability to sense when the genetic and physiological differences are established.

In this regard, the germination characters of cucurbits (bitter gourd, bottle gourd and ridge gourd) were significantly influenced by the use of biological treatments. The treatment (T₄) GA₃ @ 200 ppm with 24 hours of soaking shown the maximum germination percentage (90.15). The treatment (T₅) 100% Coconut water @ 24 hours of soaking were observed the significantly highest in shoot length (11.84), seedling length (16.91) and vigour index (1507.35). The treatment (T₆) 3% Panchagavya @ 24 hours of soaking were shown the significantly highest root length (5.52) in bitter gourd. In bottle gourd, the treatment (T₅) 100% Coconut water @ 24 hours of soaking (88.67) shown the significantly better germination percentage. The treatment (T₄) GA₃ @ 200 ppm with 24 hours of soaking were observed the highest among the shoot length (14.87), root length (11.17), seedling length (26.03) and vigour index (2299.63). In ridge gourd, the treatment (T₆) 3% Panchagavya @ 24 hours of soaking were observed the highest germination percentage (100), shoot length (13.90), root length (9.13), seedling length (23.03) and vigour index (2303.33). Similar results were observed by Kumari *et al* (2021) in ridge gourd. The maximum germination percentage with GA₃ may be due to induced enzyme activity during germination that digest the endosperm rapidly and efficiently that reduces the mechanical restraints to endosperm, thus providing energy to start and sustain embryo growth which produced rapidly during the early stage of germination. Similar findings were reported by Sowmya *et al* (2018) in bitter gourd.

The induction of membrane reliability and quantifiable changes of seeds biochemical content is due to priming. Pre-sowing treatment enhances the physiological activities during seed germination and soaking the seeds in GA₃ stimulates biochemical processes like hydrolysis, metabolism of growth inhibitors, activation of enzymes required for plant germination (Ayaz *et al.*, 2019). Treatment with coconut water were found the effective in enhancing seed germination in bottle gourd. Due to the presence of growth hormones like cytokinins (kinetin and *trans*-zeatin) in coconut, breaks the hard seed coat and enhances the germination percentage. Panchagavya having enriched with the essential macro and micro nutrients favours for the growth of the crop. Panchagavya exhibits highest amount of macro and micro nutrients like nitrogen, potassium, magnesium, sodium, iron, molybdenum. Also, highest amount of phyto-hormones likes auxin, gibberellin and cytokimim were present in panchagavya (Uthirapandi *et al.*, 2018).

Conclusion

The present experiment results indicates that pre-sowing treatment is an alternate strategy to maintain the vigour of a seed under various factors. It is concluded that seeds of bitter gourd, bottle gourd and ridge gourd give best results after treating with GA₃ @ 200 ppm for 24 hours of soaking followed by 100% Coconut water @ 24 hours of soaking and 3% Panchagavya @ 24 hours of soaking.

REFERENCES

- Adebisi, M. A. (2004). Variation, stability and correlation studies in seed quality and yield characters of sesame Unpublished Ph.D Thesis. Department of Plant Breeding and Seed Technology, Federal University of Agriculture, Abeokuta, Ogun State. 117pp.
- Adelani, D. O. and Maisamari, I. J. (2016). Effect of fresh cow milk and coconut milk on the germination of baobab (*Adansonia digitata*) seeds. *Biological and Environmental Sciences Journal for the Tropics*, 8(4): 7-16.
- Ayaz, A., Ayub, G., Khan, M. and Shah, S. A. A. (2019). Influence of gibberllic acis concentrations and dipping durations on growth and yield of bitter gourd. *Sarhad Journal of Agriculture*, 35(2): 587-593.
- Dunsin, O., Aboyeji, C. M. and Nayan, G. (2016). Influence of moringa leaf extract and coconut water as priming agent to improve the emergence and early seedling growth in cucumber. *International Journal of Organic Agriculture Research and Development*, 12: 39-46.
- Kumari, A., Chaurasia, A. K., Shukla, P. K., Patil, P. D. and Dubey, S. (2021). Impact of seed invigoration with panchagavya, beejamrutha on seed quality parameters in ridge gourd (*Luffa acutangula*) under salinity conditions. *The Pharma Innovation Journal*, 10(9): 1823-1826.

- Lededa, A., Widrlechner, M., Staub, J., Ezura, H., Zalapa, J. and Kristkova, E. (2007). Cucurbits (Cucurbitaceae; Cucumis spp., Cucurbita spp., Citrullus spp.). *Genetic Resources, Chromosome Engineering, and Crop Improvement: Vegetable Crops 3*: 271.
- Mavi, K., Ermis, S. and Demir, I. (2006). The effect of priming on tomato rootstock seeds in relation to seedling growth. *Asian Journal of Plant Sciences*, 5(6): 940-947.
- Nawaz, J., Hussain, M., Jabbar, A., Nadeem, G. A., Sajid, M., Subtain, M. U. and Shabbir, I. (2013). Seed priming a technique. *International Journal of Agriculture Crop Science*, 6(20): 1373.
- Patil, P. D., Chaurasia, A. K., Shukla, P. K., Dubey, S. and Kumari, A. (2021). Impact of seed invigoration with panchagavya, beejamrutha on seed quality parameters in bitter gourd (*Momordica charantia*) under salinity conditions. *Biological Forum-An International Journal*, 13(3): 21-26.
- Rahman, S., Ahmed, I., Biswas, S., Morshed, M., Sarker P. C., Hossain. A., Islam, M., Jahan, T. and Choudhury, A. K. (2021). Effect of milk and hydro-priming on seed germination characteristics of bitter gourd (*Momordica charantia* L.). *Turkish Journal of Agriculture-Food Science and Technology*, 9(2): 296-300.
- Rao, M. J., Hussain, S., Anjum, M. A., Saqib, M., Ahmad, R., Khalid, M. F., Sohail, M., Nafees, M., Ali, M. A., Ahmad, N., Zakir, I. and Ahmad, S. (2019). Effect of seed priming on seed dormancy and vigor. *Springer Nature Singapore Pte Ltd.*, pp. 135-145.
- Sowmya, H. M., Kolakar, S. S., Nadukeri, S., Lakshmana, D., Srinivasa, V. and Jakkeral, S. A. (2018). Influence of seed priming with gibberellic acid on antidiabetic vine – bitter gourd (*Momordica charantia* L.) genotypes. *Journal of Pharmacognosy and Phytochemistry*, SP3: 161-164.
- Thangamani, C., Pugalendhi. L., Sumathi, T., Kavitha, C. and Rajashree, V. 2011. Estimation of combining ability and heterosis for yield and quality characters in bitter gourd (*Momordica charantia* L.). *Electronic Journal of Plant Breeding*, 2(1):62-66.
- Uthirapandi, V., Suriya, S., Boomibalagan, P., Eswaran, S., Ramya, S. S., Vijayanand, N. and Kathiresan, D. (2018). Organic fertilizing effect of panchagavya on growth and biochemical parameters of holy basil (*Ocimum sanctum* L.). *International Journal of Current Microbiology and Applied Science*, 7(6): 2637-2644.

Table: 1 Mean performance on effect of germination percentage of bitter gourd

Treatments	Germination %			Shoot length			Root length			Seedling length			Vigour index		
	Bitter gourd	Bottle gourd	Ridge gourd	Bitter gourd	Bottle gourd	Ridge gourd	Bitter gourd	Bottle gourd	Ridge gourd	Bitter gourd	Bottle gourd	Ridge gourd	Bitter gourd	Bottle gourd	Ridge gourd
T1	73.36	72.75	73.33	8.44	14.03	9.47	3.97	8.70	5.77	12.41	21.63	15.23	9.13	15.76	11.19
T2	76.67	77.22	50.00	9.70	11.87	9.40	4.73	10.17	9.13	14.83	21.67	18.53	11.41	16.79	9.80
T3	84.19	76.00	66.67	9.53	12.13	12.97	4.23	8.10	5.47	13.80	21.30	18.43	11.67	16.22	12.56
T4	90.15	88.00	91.67	11.40	14.87	12.10	5.00	11.17	6.27	16.40	26.03	18.37	14.84	23.00	17.05
T5	88.74	88.67	85.00	11.84	13.33	13.07	5.07	10.73	8.93	16.91	24.07	22.00	15.07	21.53	18.91
T6	76.60	88.33	100.00	11.08	13.80	13.90	5.52	10.33	9.13	16.60	24.13	23.03	12.75	21.43	23.03
T7	78.84	75.33	71.67	10.57	11.43	10.74	4.33	9.40	7.63	14.93	21.23	18.37	11.86	16.03	13.40
T8	78.15	76.33	75.00	9.92	11.67	9.83	4.53	9.90	6.40	14.12	22.87	16.23	11.11	17.49	12.15
MEAN	80.84	80.33	76.67	10.31	12.89	11.43	4.67	9.81	7.34	15.00	22.87	18.78	12.230	18.530	14.760
SE (m)	3.72	4.1	9.37	0.65	0.74	1.10	0.25	0.35	0.50	0.94	1.03	1.35	1.24	1.78	2.46
CD AT 5%	11.16	12.28	28.1	1.95	2.21	3.29	0.75	1.04	1.48	2.82	3.08	4.03	3.73	5.34	7.39

UNDER PEER REVIEW