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# Efficacy of bio-agents as root dip treatment against root-knot nematode, *M. incognita* on brinjal

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**ABSTRACT:** To find out the eco-friendly and economically feasible method for management of root-knot nematode, *M. incognita* infecting brinjal through fungal and bacterial bio-agents as root dip treatment were tested. Root dip treatment was done with *T. harzianum*, *T. viride* and *P. fluorescens* at two doses *viz.*, 5 g, and 10 g per litre water and the chemical check carbosulfan 25 EC at 2 per cent were used. Results revealed that *T. harzianum* at 10 g per litre water was the best treatment as compared with *T. viride* at 10 g per litre water and *P. fluorescens* at 10 g per litre water in improving plant growth as well as in reducing nematode population over other treatment.

**Key Words:** Bio-agents, root-knot nematode, root dip treatment, brinjal.

Brinjal (*Solanum melongena* L.) also known as egg plant, belongs to family Solanaceae, is an important vegetable crop grown throughout the world, specially in South Asia and the origin is India. In India, the total area under brinjal cultivation is 0.7 million hectares with an annual production of 12.2 million tonnes (FAO, 2012-13), while in Rajasthan it is grown in 0.055 lac hectare area with an annual production of 0.28 lac tonnes (Anonymous, 2012-13). In Rajasthan it is grown in all the districts during summer and rainy season. It has high nutritional values containing 92.7 g moisture, 1.4 g protein, 0.3 g fat, 0.3 g minerals, 1.3 g fibers, 4.0 g carbohydrates, 124 international unit vitamin A, and 12 mg vitamin C per hundred grams of edible portion (Choudhary, 1983). The brinjal has got "Ayurvedic" medicinal properties, white brinjal is said to be good for diabetic patients. Further, it contains the antioxidant chemicals called anthocyanins, which protect the body from cancer, neurological diseases, inflammation and aging.

Various attempts to promote the yield and quality of this commercially grown vegetable crop have been made by investigating high yielding varieties and improving the package of practices for its cultivation. However, all such efforts are nullified in absence of suitable protection strategy against pest and diseases. Various factors have been recognized for low yield of brinjal, poor quality of seed and incidence of disease and pest and adverse climatic condition. Among all the known factors, the incidences of disease significantly affect the production. Almost all the stages of brinjal crop right from nursery to maturity are attacked by large spectrum of diseases caused by fungi, bacteria, viruses, insects and nematodes. Out of these the damage caused by nematodes has been quite significantly realized. Several nematodes are known to be associated with brinjal. *Meloidogyne* spp., *Hoplolaimus* spp. and *Rotylenchulus* spp. are the most frequently occurring nematodes and causing economic losses. Out of which the losses caused by root-knot nematode *(M. incognita*) to this crop has been much devastating than others.

The root-knot nematodes produce galls and damage the roots of many vegetable crops, thus causing severe losses. The root-knot nematode is known to attack more than 3000 species of host plants. In India, over 350 plants are known as the host of *Meloidogyne spp*. *M. incognita* alone infecting about 250 genera of plants. Losses caused by root-knot nematode, *M. incognita* were estimated to be 33.68 per cent in brinjal.

The management of nematodes is more difficult than that of other pests because nematodes mostly inhabit the soil and usually attack the underground parts of the plants. There are number of practices for management of plant parasitic nematodes in which chemical nematicide is used against nematodes by farmer because it is effective, easy to apply, and show rapid effects. But on the other hand it may cause degradation in soil fertility, environmental pollution and also hazardous for animals and human being. Looking in to this more emphasis is now being given on biological control as these are more feasible, economical and environmentally safer.

Biological control of plant parasitic nematodes may be a safer alternative in sustainable agriculture because it is based on the management of a natural resource. Biological control of nematodes is considered to encompass control that results from the action of soil microorganisms and the soil micro fauna, which is mediated through mechanisms such as parasitism, predation, competition and antibiosis. Several organisms, such as fungi, bacteria, viruses, predatory nematodes, insects, mites and some invertebrates have been found to parasitize or prey upon nematodes but among these fungal and bacterial antagonists were most widely used in management of nematodes and have received greater attentions (Krishanppa and Shreenivasa, 2009).

**Table-1:** Efficacy of bio-agents as root dip treatment against root-knot nematode, *M. incognita* on brinjal.

| | Treatments | Plant growth characters | | | | Nematode reproduction | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Shoot length (cm) | Root length (cm) | Shoot weight (g) | Root weight (g) | No. of galls /plant | No.of egg masses / plant | No.of eggs /egg mass | Nematode population /100cc soil | Total population |
| **$T_1$** | *T. viride* 5g/litre water | 22.93 | 17.33 | 13.20 | 4.40 | 35.00 | 24.00 | 140.00 | 230 | 3625 |
| **$T_2$** | *T. viride* 10g/litre water | 26.73 | 20.63 | 17.00 | 5.90 | 31.00 | 19.00 | 123.00 | 193 | 2561 |
| **$T_3$** | *T. harzianum* 5g/litre water | 24.55 | 18.40 | 14.80 | 4.80 | 33.00 | 21.33 | 133.00 | 218 | 3088 |
| **$T_4$** | *T. harzianum*10g/litre water | 30.00 | 22.63 | 20.00 | 6.97 | 28.00 | 17.00 | 100.67 | 180 | 1919 |
| **$T_5$** | *P. fluorescens* 5g/litre water | 20.47 | 16.50 | 12.00 | 4.00 | 37.33 | 27.67 | 153.33 | 242 | 4522 |
| **$T_6$** | *P. fluorescens* 10g/litre water | 25.50 | 19.67 | 15.83 | 5.00 | 32.00 | 20.00 | 127.00 | 201 | 2773 |
| **$T_7$** | Chemical check (Carbosulfan 25 EC @ 2%) | 35.00 | 27.00 | 24.33 | 7.33 | 17.33 | 10.33 | 82.00 | 97 | 961 |
| **$T_8$** | Untreated check | 16.67 | 12.83 | 8.37 | 3.40 | 43.00 | 41.67 | 208.00 | 391 | 9101 |
| | **SEm±** | **0.748** | **0.733** | **0.673** | **0.240** | **1.028** | **0.951** | **2.974** | **6.205** | **186.189** |
| | **CD at 5%** | **2.242** | **2.199** | **2.017** | **0.721** | **3.083** | **2.851** | **8.916** | **18.603** | **558.194** |

**Note:** (i) Data are average value of three replications (ii) Initial inoculums level 2 juvenile/g soil

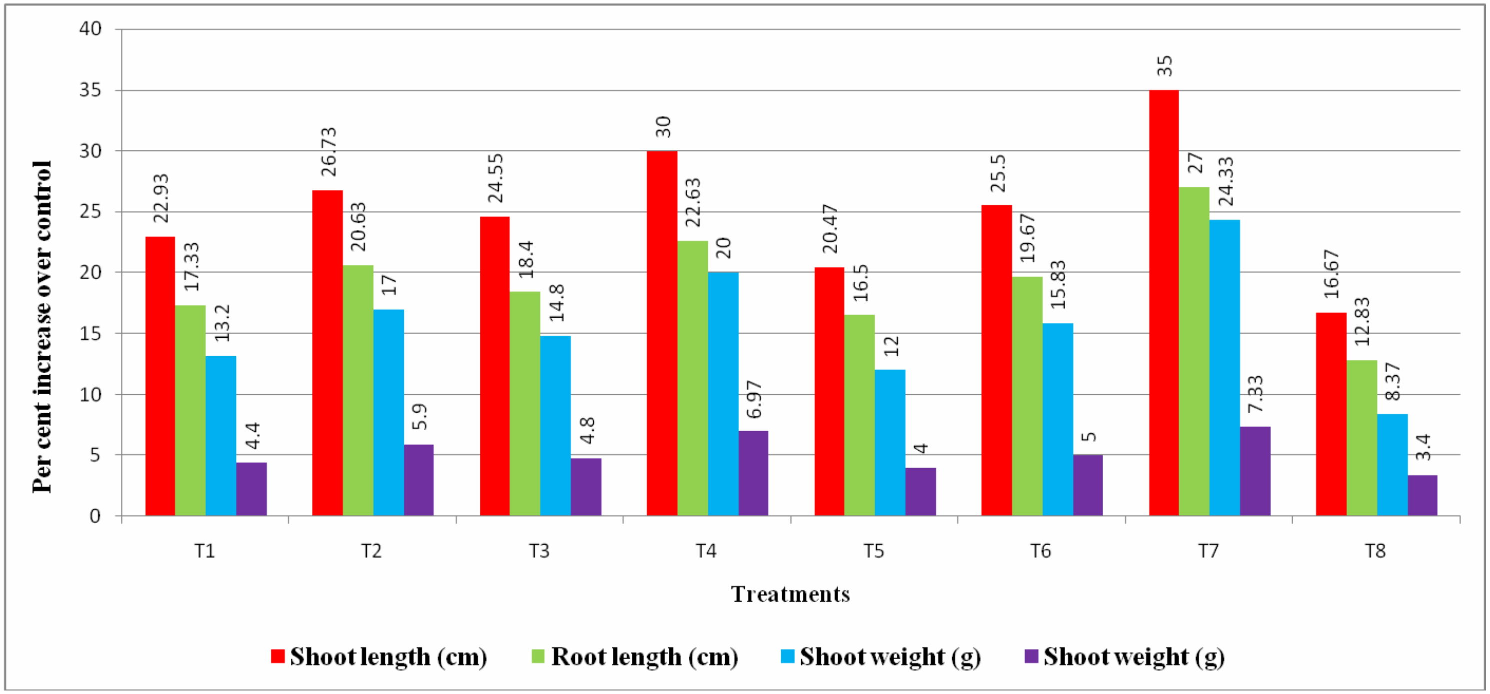


**Fig.-1:** Efficacy of bio-agents as root dip treatment on plant growth of brinjal infested with root-knot nematode, *M. incognita.*

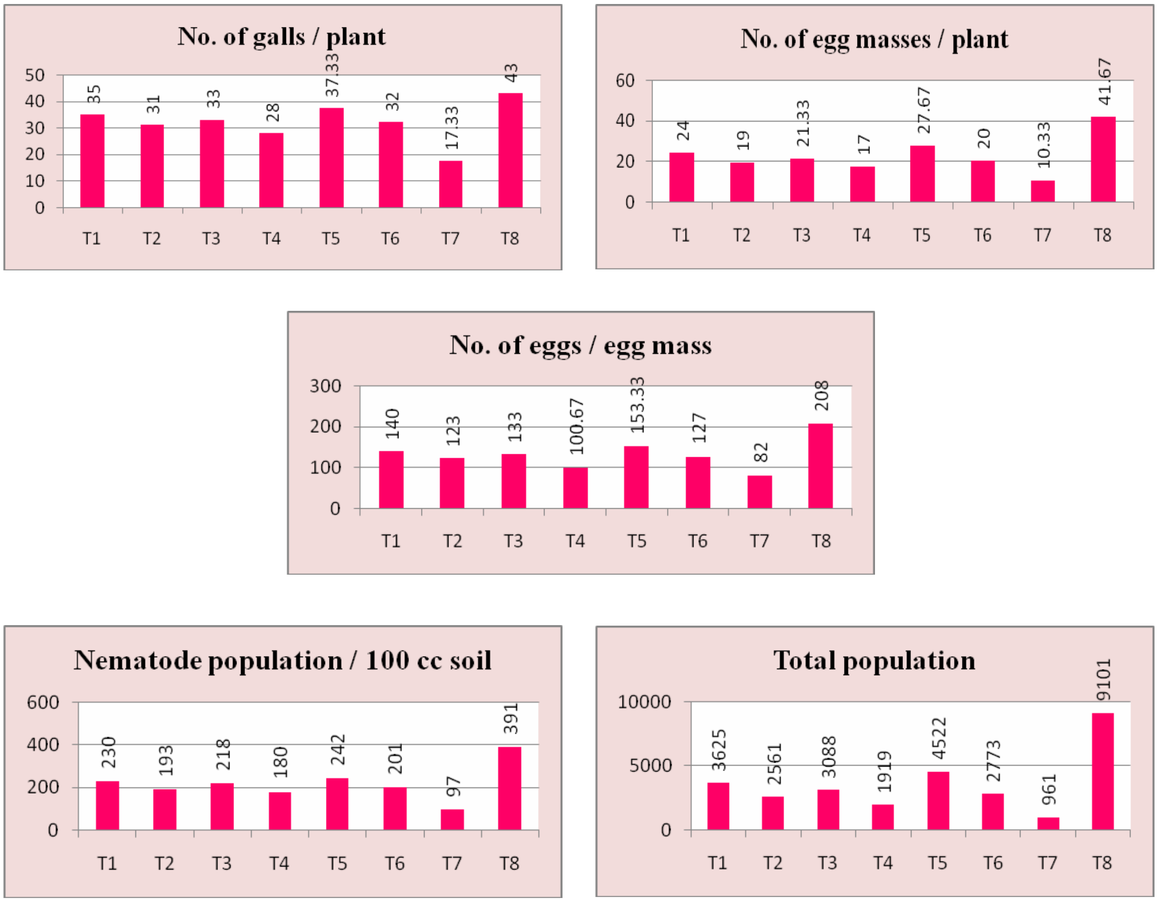


**Fig.-2:** Efficacy of bio-agents as root dip treatment against root-knot nematode, *M. incognita* on brinjal.

## Materials and Methods

The experiment was laid out in pots filled with root-knot nematode infested soil carried from the pure culture plots of Department of Nematology, RCA, Udaipur. Talc–based formulation of *T. viride*, *T. harzianum* and *P. fluorescens* were used as root dip treatment each at 5 g and 10 g per litre water. Three to four week old seedlings of brinjal were uprooted carefully without disturbing their root system and gently washed under tap water for removing of soil. Thereafter seedlings of brinjal were dipped in each suspension of *T. viride, T. harzianum* and *P. fluorescens* for 30 minutes. After 30 minutes the dipped seedlings were transplanted in pots having infested soil carried from the pure culture plots. Each treatment was replicated three times. After 10 days of transplanting, one plant of each pot was maintained and one treatment having nematode alone (control) and chemical check (Carbosulfan 25 EC at 2 per cent) were also maintained for comparison. The plants were harvested after 45 days of transplanting. Observations on shoot length, shoot weight, root length and root weight were taken at harvest. Then the root were washed carefully and stained with 0.1 per cent acid fuchsin in lacto phenol and kept in clear lacto phenol for 24 hrs. Thereafter, the roots were examined thoroughly under a stereoscopic binocular microscope for counting number of galls per plant, number of egg masses per plant and number of eggs per egg mass. Statistical analysis was done after termination of experiment. The results have been presented in Table-1 and illustrated through Fig.-1 & 2.

## Results and Discussion

Root dip treatment was done with suspension of *T. harzianum*, *T. viride* and *P. fluorescens* at 5g and 10g per litre water in order to find out the suitable dose for the management of root-knot nematode on brinjal. Experimental findings exhibited that root dip treatment with bio-agents significantly enhanced growth parameters of brinjal *viz.* shoot length and weight, root length and weight and suppressed the nematode reproduction *viz.* number of galls per plant, number of egg masses per plant, number of eggs per egg mass, final nematode population per 100 cc soil and total nematode population over untreated check (nematode alone).

Among the bio-agents tested maximum increase in plant growth characters of brinjal and reduction in nematode reproduction was observed with *T. harzianum* followed by *T. viride* and *P. fluorescens*. Among the different doses *T. harzianum* 10g per litre used as root dip treatment was found superior over *T. viride* and *P. fluorescens* at the same doses, in improving plant growth characters and reducing nematode reproduction. However, highest reduction in nematode population was recorded with the root dip treatment with carbosulfan 25 EC at 2 per cent.

These findings are in agreement with the results of Rao *et al*. (1999) who reported that the bare root dip treatment of tomato seedlings in castor (*Ricinus communis*) leaf aqueous extract (5 or 10 per cent) mixed with *P. lilacinus* spores significantly increased the plant growth parameters and reduced the root-knot index and nematode population in comparison to the calotropis (*Calotropis procera*) leaf extract (5 or 10 per cent) + *P. lilacinus*, and *P. lilacinus* alone. Gomathi *et al.* (2006) reported that application of *Pasteuria penetrans* as seed treatment, soil application and seedling root dip treatment at $6x10^6$ spores per g of soil significantly suppressed the root-knot nematode (*Meloidogyne incognita*) population (73.4 per cent) and number of egg masses (77.7 per cent) in brinjal. Shanmuga *et al*. (2006) observed that application of *P. lilacinus* at $8x10^6$ spores per 50 seedlings as seedling root dip treatment significantly increased the shoot length as compared to control.

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