



ISSN Print: 2664-844X
 ISSN Online: 2664-8458
 NAAS Rating (2026): 4.97
 IJAFA 2026; 8(4): 457-460
www.agriculturaljournals.com
 Received: 17-01-2026
 Accepted: 20-02-2026

Pallavi B Bhalerao

Ph.D. Research Scholar,
 Department of Plant
 Pathology and Microbiology,
 Post Graduate Institute,
 Mahatma Phule Krishi
 Vidyapeeth, Rahuri,
 Ahilyanagar, Maharashtra,
 India

SV Kolase

Professor (CAS),
 Department of Plant
 Pathology and Microbiology,
 PGI, Mahatma Phule Krishi
 Vidyapeeth, Rahuri,
 Ahilyanagar, Maharashtra,
 India

SB Latake

Associate Professor,
 Department of Plant
 Pathology and Microbiology,
 PGI Mahatma Phule Krishi
 Vidyapeeth, Rahuri,
 Ahilyanagar, Maharashtra,
 India

BT Patil

Head, Department of
 Horticulture, PGI, Mahatma
 Phule Krishi Vidyapeeth,
 Rahuri, Ahilyanagar,
 Maharashtra, India

MR Patil

Head, Department of Statistics
 PGI, Mahatma Phule Krishi
 Vidyapeeth, Rahuri,
 Ahilyanagar, Maharashtra,
 India

Corresponding Author:

Pallavi B Bhalerao

Ph.D. Research Scholar,
 Department of Plant
 Pathology and Microbiology,
 Post Graduate Institute,
 Mahatma Phule Krishi
 Vidyapeeth, Rahuri,
 Ahilyanagar, Maharashtra,
 India

In vitro evaluation of bioagents against *Sclerotium rolfsii* causing collar rot in brinjal

Pallavi B Bhalerao, SV Kolase, SB Latake, BT Patil and MR Patil

DOI: <https://www.doi.org/10.33545/2664844X.2026.v8.i4f.1469>

Abstract

Brinjal (*Solanum melongena* L.) is an important vegetable crop widely cultivated in India; however, its productivity is significantly constrained by collar rot disease caused by *Sclerotium rolfsii* Sacc., a destructive soil-borne pathogen. Considering the economic importance of the crop and the severe yield losses caused by this disease, the present investigation was undertaken to evaluate the efficacy of bioagents against *S. rolfsii* under *in vitro* conditions.

Infected brinjal plants exhibiting typical collar rot symptoms were collected from field conditions, and the pathogen was isolated on Potato Dextrose Agar (PDA). The pathogenicity of the fungus was confirmed using the sick soil method under screen house conditions. A total of seven bioagents were evaluated *in vitro* against *S. rolfsii* using the dual culture technique on PDA medium.

Observations on radial mycelial growth (colony diameter in mm) of the test pathogen were recorded at 24-hour intervals up to seven days or until the control plates were fully covered. All the bioagents tested significantly inhibited the mycelial growth of *S. rolfsii* compared to the untreated control.

Among the treatments, *Trichoderma harzianum* was found to be the most effective bioagent, recording the minimum mean colony diameter (29.43 mm) with maximum inhibition (67.30%), followed by *Trichoderma asperellum* (31.00 mm; 65.55%). *Pseudomonas fluorescens* (32.22 mm; 64.20%) and *Bacillus subtilis* (34.57 mm; 61.58%) also showed significant antagonistic activity. *T. hamatum* and *T. virens* were comparatively less effective.

Keywords: Brinjal, *Solanum melongena*, collar rot, *Sclerotium rolfsii*, bioagents, *Trichoderma harzianum*

Introduction

Brinjal (*Solanum melongena* L.) is an important vegetable crop grown in India and other parts of the world. It can be grown in almost all parts of the country except at higher altitudes all the year around. Brinjal is said to be the native of India (Thompson and Kelly, 1957) [21]. It belongs to the economically important family *Solanaceae*. This solanaceous crop is India's contribution to the global palate. Regarding nutritional value per 100 g, brinjal has a very low caloric value (24 Kcal), protein (2%) and vitamin C (2.2 mg) but is a very good source of dietary fibre (3.4 g), potassium (230 mg), manganese (14 mg), calcium (9 mg), copper (0.082 mg) and thiamin (0.039 mg) (Naem and Ozgen, 2019) [12].

The disease was first reported in India by P. Madhava Rao (1969) [9] in Vijayawada district of Andhra Pradesh and the fungus *Sclerotium rolfsii* sacc was first time seen in Florida on tomato plants by Peter Henry Rolfs (1892) [16] but the name was coined by Saccardo (1911) [17]. The common diseases and their pathogens are, damping off (*Pythium aphanidermatum*, *Phytophthora* spp. and *Rhizoctonia* spp), Leaf spots (*Alternaria melongena* L, *Alternaria solani*, *Cercospora melongena*, C. Solani), Wilt (*Fusarium solani*, *Verticillium dahliae*), Collar rot (*Sclerotium rolfsii* sacc.), Powdery mildew (*Erysiphe cichoracearum*), Root knot nematode (*Meloidogyne javanica*), Phomopsis blight and fruit rot (*Phomopsis vexans*) and little leaf of brinjal caused by Mycoplasma like organism which are causing In recent years, collar rot caused by *Sclerotium rolfsii* Sacc. has emerged as one of the serious soil-borne diseases of brinjal in western Maharashtra, causing heavy losses particularly under warm and humid conditions.

The pathogen of collar rot, *Sclerotium rolfsii* sacc., has become one of the major threats both under nursery and field cultivated brinjal crop. It attacks the seedlings in the nursery bed as well as adult plants in the transplanted fields. The severity of the pathogen can be attributed

to the ability of its sclerotia to withstand adverse conditions (Singh and Singh, 1994) ^[20]. *S. rolfsii* sacc. is a soil borne facultative pathogen, belonging to the sub division Deuteromycotina. It is especially severe on legumes, solanaceous crops and cucurbits. Collar rot disease incidence of 60- 100% in brinjal has been reported (Siddique *et al*, 2016; Hasan and Meah, 2019) ^[18, 6] with 16-30% yield losses (Singh and Dhancholia, 1991; Jadon, 2009) ^[19, 7]. Infestation from seedling to flowering stages may result in 100% crop loss.

Materials and Methodology

Isolation, Identification and Pathogenicity

The fungi associated collar rot of brinjal was isolated by applying tissue isolation technique (Tuite, 1969) ^[22]. Naturally infected brinjal plants showing typical collar rot symptoms were collected from the fields, thoroughly washed with distilled water, blot dried and cut with sharp sterilized blade into small bits (5 mm) and then surface sterilized with 1 per cent aqueous solution of Sodium hypochlorite (NaOCl) for two minutes. Subsequently, these bits were washed thoroughly by giving three sequential changes with sterile distilled water to remove traces of Sodium hypochlorite if any, blot dried and aseptically transferred on to autoclaved and cooled Potato dextrose agar PDA medium in sterile glass Petri plates (90 mm), under Laminar air-flow cabinet and incubated in BOD incubator at 27 ± 2 °C temperature. These inoculated PDA plates were observed at regular interval for growth of the pathogenic fungi. After a weak of incubation, typical fungal growths developed on PDA plates were transferred into fresh PDA plates and incubated further. By applying hyphal tip isolation technique (Tuite, 1969) ^[22], purified, and sub-cultured the cultures and their pure cultures on Agar slant tubes were maintained in refrigerator, for further studies.

Pathogenicity

The pathogenicity of pathogens was tested by sick soil inoculation technique in the earthen pot under greenhouse condition by using susceptible brinjal variety Manjari Gota. To prove the pathogenicity of the fungus by soil inoculation techniques, the inoculum of the fungus was prepared as per the method given by Biswas Sen (2000) ^[3]. Sterilized sand maize meal medium was prepared in 250 ml conical flask (10 g maize meal + 90 g washed sand + 15 ml distilled water) was inoculated with two discs of 5 mm diameter mycelial plug of three days old culture grown on PDA plates. Inoculated flasks were incubated at room temperature (27 ± 2 °C). After 7th days of incubation, the inoculum was mixed with sterilized soil in 1:1 ratio. Each earthen pot was filled with 3 kg of sterilized soil and the inoculum mixture was applied @ 60 g/kg soil. The next steps of soil inoculation were carried out according to the procedure described by Agrwal and Kotasthane (1971) ^[1]. Surface sterilized seeds were sown in each pot on 6th days of soil inoculation. Three replications of each treatment were maintained. Uninoculated soil in earthen pot served as control. Observation on pre emergence mortality was taken on 7th day of sowing while post emergence mortality on 21st

days of sowing. The infected seeds and seedling were subjected to re-isolation to confirm Koch's postulates

In vitro evaluation of the bioagents

Most potential fungal and bacterial biocontrol agents were evaluated in vitro against the test fungi *S. rolfsii*, by applying Dual culture technique (Dennis and Webster, 1971) ^[4] and using PDA as basal culture medium. Seven days old cultures of the test bioagents and test fungi grown on respective culture media were used for the study. One each 5 mm culture disc of the test fungus and the test fungal bio agents cut out with sterilized cork-borer was placed at equidistance and exactly opposite to each other on autoclaved and solidified PDA medium in Petri plates. For bacterial biocontrol agents, a culture disc (5 mm) for the test fungus was placed along periphery of the PDA plate and exactly opposite to it pure culture suspension of the test bacterial biocontrol agent was streaked with inoculation needle loop. The PDA plates separately inoculated (in the centre) alone with pure culture disc of the test fungus were maintained as untreated control

Design	:	Completely Randomised Design.
Replications	:	Three
Treatments	:	Seven

Treatment details

Tr. No.	Bio-agents used
T ₁	<i>Trichoderma harzianum</i>
T ₂	<i>Trichoderma asperellum</i>
T ₃	<i>Trichoderma hamatum</i>
T ₄	<i>Trichoderma virens</i>
T ₅	<i>Pseudomonas fluorescens</i>
T ₆	<i>Bacillus subtilis</i>
T ₇	Control

Observations on radial mycelial growth or diameter of colony of the test pathogen were taken after seven days of inoculation. Per cent mycelial growth inhibition of the pathogen with the bioagents, over the untreated control, was calculated by using the formula given by Vincent (1947) ^[23].

$$I = \frac{(C-T)}{C} \times 100$$

Where,

I = Per cent inhibition (mm),

C = Growth of fungus in control plate (mm)

T = Growth of fungus in treatment plate (mm)

Result: A total of four fungal bioagents and two bacterial bioagents were evaluated for their antagonistic activity *in vitro* by using the dual culture technique against *Sclerotium rolfsii* which exhibited a wide range of mycelial growth and inhibition of the test pathogen. The results revealed that all the bioagents exhibited antifungal activity against *S. rolfsii* and significantly inhibited mycelial growth as compared to the untreated control.

Effect of bioagent on the mycelial growth of *S. rolfii*

Tr. No	Bioagents	Mean colony diameter (mm)	Inhibition over control
T ₁	<i>Trichoderma harzianum</i>	29.43	67.30 (55.12)
T ₂	<i>Trichoderma asperellum</i>	31.00	65.55 (54.05)
T ₃	<i>Trichoderma hamatum</i>	42.54	52.73 (46.56)
T ₄	<i>Trichoderma virens</i>	43.16	52.00 (46.12)
T ₅	<i>Pseudomonas fluorescens</i>	32.22	64.20 (53.24)
T ₆	<i>Bacillus subtilis</i>	34.57	61.58 (51.69)
T ₇	Control (untreated)	90.00	00
	S.E(m) ±	0.73	
	CD at 1%	2.19	

*Figures in parentheses are arcsine Transformed values

The results revealed that among the different treatments, *Trichoderma harzianum* was found to be the most effective bioagent in suppressing the growth of *S. rolfii*, which recorded the minimum mean colony diameter of 29.43 mm with highest inhibition (67.30 followed by *Trichoderma asperellum* which recorded a mean colony diameter of 31.00 mm with 65.55 per cent inhibition. The next effective treatment was *Pseudomonas fluorescens* which showed 32.22 mm colony diameter with 64.20 per cent inhibition over control.

Similar results were recorded by Kumar and Sen (2000) [8], Pan and Mukhopadhyay (2001) [13], Rakholiya and Jadeja (2010) [15], Bhuiyan *et al.* (2012) [2] and Manu *et al.* (2012) [11] they reported that *T. harzianum* showed strong antagonistic activity toward *S. rolfii* under *in vitro* condition. Dutta and Das (2002) [5], Pan *et al.* (2009) [14] and Madhavi and Bhattiprolu (2011) [10] found that *T. harzianum* was more growth inhibitory followed by *T. asperellum* against *S. rolfii*.

Conclusion

All six bioagents evaluated *in vitro* significantly inhibited mycelial growth over untreated control, of the test pathogenic fungi *S. rolfii* causing collar rot in brinjal. However, in *S. rolfii*, significantly highest mycelial growth inhibition resulted with *T. harzianum* (67.30%) followed by

T. asperellum (65.55%), *Pseudomonas fluorescens* (64.20%), *Bacillus subtilis* (61.58%), *T. hamatum* (52.73%), *T. virens* (52.00%).

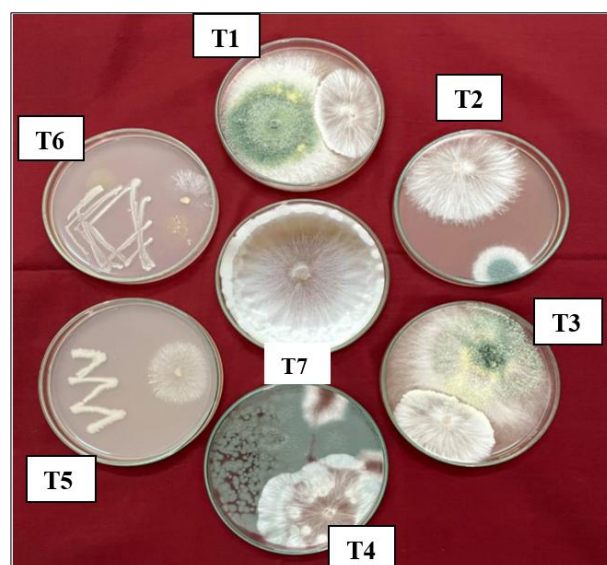


Plate 1: *In vitro* efficacy of bioagents against *Sclerotium rolfii* causing collar rot of brinjal

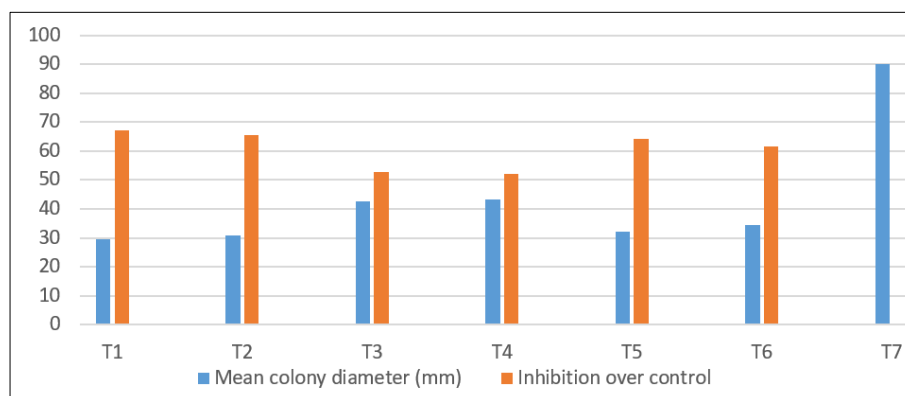


Fig 1: *In vitro* efficacy of bioagents against *Sclerotium rolfii* causing collar rot of brinjal

T ₁	<i>Trichoderma harzianum</i>
T ₂	<i>Trichoderma asperellum</i>
T ₃	<i>Trichoderma hamatum</i>
T ₄	<i>Trichoderma virens</i>
T ₅	<i>Pseudomonas fluorescens</i>
T ₆	<i>Bacillus subtilis</i>
T ₇	Control (untreated)

References

- Agarwal VK, Kotasthane SR. Effect of fungal metabolites on seed germination and seedling growth. *Indian Phytopathol.* 1971;24(1):170-172.
- Bhuiyan MAH, Rahman MT, Bhuiyan KA, Hossain MM. In vitro evaluation of *Trichoderma* spp. against *Sclerotium rolfsii*. *Bangladesh J Plant Pathol.* 2012;28(1):15-20.
- Biswas Sen C. Studies on management of soil-borne pathogens using organic amendments. *J Mycol Plant Pathol.* 2000;30(1):123-127.
- Dennis C, Webster J. Antagonistic properties of species-groups of *Trichoderma*. *Trans Br Mycol Soc.* 1971;57(1):25-39.
- Dutta S, Das K. Biological control of *Sclerotium rolfsii* by *Trichoderma* spp. *J Mycopathol Res.* 2002;40(1):27-30.
- Hasan MM, Meah MB. Management of collar rot of brinjal caused by *Sclerotium rolfsii*. *Int J Plant Soil Sci.* 2019;28(1):1-8.
- Jadon KS. Studies on collar rot of brinjal caused by *Sclerotium rolfsii*. M.Sc. (Agri.) Thesis. Bikaner: Rajasthan Agricultural University; 2009.
- Kumar R, Sen B. Antagonistic potential of *Trichoderma* spp. against soil-borne pathogens. *Indian Phytopathol.* 2000;53(3):345-348.
- Madhava Rao P. Collar rot of brinjal caused by *Sclerotium rolfsii* in Andhra Pradesh. *Indian Phytopathol.* 1969;22(2):185-186.
- Madhavi GB, Bhattiprolu SL. Evaluation of bioagents against *Sclerotium rolfsii*. *J Biol Control.* 2011;25(2):110-114.
- Manu TG, Nagaraja A, Chetan H, Mallikarjun K. Biological management of soil-borne pathogens using *Trichoderma* spp. *Karnataka J Agric Sci.* 2012;25(2):217-220.
- Naeem M, Ozgen M. Nutritional composition and antioxidant activity of eggplant (*Solanum melongena* L.). *J Food Compos Anal.* 2019;79:103-108.
- Pan S, Mukhopadhyay AN. Evaluation of *Trichoderma* spp. against soil-borne plant pathogens. *Indian Phytopathol.* 2001;54(1):50-55.
- Pan S, Chakraborty U, Chakraborty BN. Biological control of *Sclerotium rolfsii* by *Trichoderma* spp. *J Plant Prot Res.* 2009;49(1):15-20.
- Rakholiya KB, Jadeja KB. Biological control of soil-borne plant pathogens by *Trichoderma* spp. *J Plant Prot Res.* 2010;50(1):36-40.
- Rolfs PH. Tomato blight caused by *Sclerotium rolfsii*. *Bull Florida Agric Exp Stn.* 1892;18:65-78.
- Saccardo PA. *Sylloge Fungorum*. Vol. 20. Padova: Italy; 1911.
- Siddique MA, Rahman MA, Hossain MS. Incidence and severity of collar rot disease in brinjal. *Bangladesh J Agric Res.* 2016;41(1):123-130.
- Singh RS, Dhancholia S. Yield losses due to collar rot of brinjal caused by *Sclerotium rolfsii*. *Indian Phytopathol.* 1991;44(1):87-89.
- Singh RS, Singh US. Survival and pathogenic behaviour of *Sclerotium rolfsii*. *J Mycol Plant Pathol.* 1994;24(1):91-94.
- Thompson HC, Kelly WC. *Vegetable crops*. New York: McGraw-Hill Book Company; 1957.
- Tuite J. *Plant pathological methods: fungi and bacteria*. Minneapolis: Burgess Publishing Company; 1969.
- Vincent JM. Distortion of fungal hyphae in the presence of certain inhibitors. *Nature.* 1947;159:850.