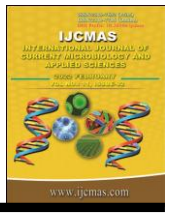
Int.J.Curr.Microbiol.App.Sci (2022) *11*(02): 245-250

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 02 (2022)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2022.1102.026

Antagonistic Activity of Some *Trichoderma* Species against *Macrophomina phaseolina* causing Okra Root Rot

Rishit Bhojani* and Hemangi Kapadiya

Department of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat-362001, India

**Corresponding author*

Keywords

Trichoderma spp., *Macrophomina phaseolina*, okra

Article Info

Received:
10 January 2022
Accepted:
05 February 2022
Available Online:
10 February 2022

A B S T R A C T

Antagonistic activity of some *Trichoderma* species viz., *Trichoderma asperellum*, *Trichoderma virens*, *Trichoderma gliocladium*, *Trichoderma viride*, *Trichoderma hamatum*, *Trichoderma koningii*, and *Trichoderma harzianum* were evaluated against *Macrophomina phaseolina in vitro* condition by dual culture technique. Among seven different antagonists tested against *M. phaseolinain vitro*, *Trichoderma asperellum* expressed significantly maximum growth inhibition (70.04%) followed by *T. hamatum* (54.81%), *T. gliocladium* (28.15%), *T. koningii* (23.70%), *T. harzianum* (22.96%), *T. virens* (22.22%) and *T. viride* (0.74%), respectively.

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) is a significant vegetable crop grown mainly due to its tender green fruits. The total world production of the okra was reported around 4.8 MT while total annual production of India was reported 6371 thousand MT (Anon., 2019 a). In India, it ranks first in its consumption. The green fruits are rich source of vitamins A and C and minerals such as Ca, Mg and Fe. Okra seeds are also good sources of protein and vegetable oil (Yadav and Dhankhar, 2001). Okra crop is grown throughout the year and is infected by many fungal pathogens, bacteria, virus and nematodes. Among them, okra is severely attacked by several soil borne fungal pathogens, which reduces the health beneficial and nutritional quality components. Keeping this in mind, the important destructive fungal soil borne pathogens causing diseases are *Rhizoctonia solani*, *Macrophomina phaseolina*, *Fusarium oxysporum* and the root knot nematodes *Meloidogyne spp.* (Ehteshamul-Haque *et al.*, 1996; Parveen *et al.*, 1994 and Sultana *et al.*, 2005).

De Candolle (1815) described the genus *Rhizoctonia* is now a well-known saprophyte, notorious soil inhabiting plant pathogen, having capacity to attack broad range of host plants globally, causing decay of fruits and seed, damping-off, stem cankers, root rots, and foliage diseases. The incidence of okra root rot (*Macrophomina phaseolina* (Tassi) Goid) ranged

from 12.7 to 58.3 per cent (Jha and Dubey, 2000). Young culture of *M. phaseolina* shows profuse growth of mycelia and dirty white sclerotia while older ones are abundantly branched with constriction at the point of origin and dark brown sclerotia along with variable size and shape (Verma *et al.,* 2006).

All the growth stages of plants are infected by root rot. The disease occurs as discoloration of stem at soil line; cankers on stem may spreading upward; leaves may wilt and drop down from the plant; numerous small black sclerota (fungal fruiting bodies) develop in affected tissues which can be even use in disease diagnosis. At present day, several disease management strategies such as, cultural, regulatory, physical, chemical (use of fungicides) and biological are considered to fight against and eradicate the phytopathogenic fungi. However, the effectiveness of these methods are only employed well when it has been taken as precautionary measures (Ganeshamoorthi *et al.,* 2010). Moreover, are as owing to the soilborne nature of *M. phaseolina,* chemical fungicides may consider less efficient for the management (Anis *et al.,* 2010).

An alternative method of synthetic chemicals, for the management of plant disease is use of biological agent (Cook and Baker, 1983) and had obtain significance in modern agriculture as a control measure of disease (Gupta *et al.,* 2018). Amid numerous biocontrol agents checked against root rot causing fungal pathogen, *Trichoderma spp.* have been proved more successful in controlling the root-rot pathogens as it has a greater capacity to withstand against wide range of temperatures (Pan and Bhagat, 2008), soil types (Mohiddin *et al.,* 2010) and microbial communities (Huagn *et al.,* 2003). *Trichoderma spp.* produces fungitoxic metabolites, trichodermin, viridin, gliotoxin, etc which can suppress the target pathogens growth and development via antibiosis process (Harman, 2006). *Trichoderma spp.* Generate several enzymes such as glucanase, cellulase, protease and chitinase to cause lysis (Vinale *et al.,* 2009).

Several studies have understandably illustrated that *Trichoderma spp.* can effectively inhibits the growth of *M. phaseolina* under in vitro condition (Arya *et al.,* 2017; Thombre and Kohire, 2018 and Manjunatha *et al.,* 2013). Hence, considering significance of the disease and requirement of present era, antagonistic activity of some *Trichoderma* species was tested against root rot pathogen under *in vitro* condition.

Materials and Methods

By usage of dual culture technique, the effect of different antagonists listed in Table 1 was studied against root rot causing fungal pathogen *M. phaseolina*.

The experimental details are given below:

Design: Completely Randomized Design (CRD)

Treatments: 8

Repetitions: 4

Method: Dual culture method (Dennis and Webster, 1971)

Dual culture technique

The antagonistic potential of seven *Trichoderma spp.* were tested against root rot causing fungal pathogen *M. Phaseolina* by dual culture technique (Dennis and Webster, 1971). In aseptic condition, at one end of every sterile plate dish having 15ml sterilized and solidified PDA medium a 9mm mycelia disc gained from five days old cultures of different *Trichoderma spp.* were placed. Similarly, at the opposite end approximately 75 mm away from the antagonist culture disc, a 9mm culture disc of the test pathogen was placed and incubated. Maintenance of the control was done by inoculating *M. Phaseolina* on both opposite ends of the Petri dish. Petri plates were incubated at 27±2 °C for duration of 5 days. Each treatment had four replications from which the radial growth of the

pathogen and the antagonists and the extent of the inhibition zone developed between the two colonies were measured precisely. The radial growth of the fungal pathogen *M. phaseolina* and percent reduction over control was calculated by the following formula (Vincett, 1927)

Percent inhibition

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

Where,

C- Mycelial growth of pathogen in control

T- Mycelial growth of pathogen in dual plate.

The design used to conduct experiment was complete randomized design (CRD) with four replicates in Petri plates. All the observations from different treatments were analyzed through one factor analysis using OPSTATE software.

Results and Discussion

All the seven *Trichoderma spp.* used as bioagents have successfully inhibited the growth of pathogen *M. phaseolina* (Table 2) when compared to controls. The per cent growth inhibition ranged from 77.04% to 0.74%. The maximum antagonistic activity was expressed by *Trichoderma asperellum* by overlapping the pathogen *M. Phaseolina* causing an inhibition zone of 77.04 per cent, followed by *T. hamatum*, *T. gliocladium* and *T. koningii* causing 54.81, 28.15 and 23.70 per cent, respectively. The percent growth inhibition exhibited by *T. harzianum* and *T. virens* were 22.96% and 22.22%. Least inhibition was recorded by *T. Viride* with 0.74% growth inhibition.

The following study is in harmony with earlier workers. Parmar and Patel (2020) observed that maximum inhibition of the mycelial growth of *M. Phaseolina* isolates was done by *T. asperellum* with 66.66 % inhibition. Abdel-lateif *et al.,* (2018) stated that *Trichoderma* genus is evidently an excellent bio control agent for the inhibition of growth of *M. phaseolina*, *Aspergillus spp*. and root knot nematode under *in vitro* as well as greenhouse conditions. Pastrana *et al.,* (2016) reported that *T. Asperellum* as an antagonist, produces competitive growth with *Macrophomina phaseolina* in terms of faster growth than the pathogen and gaining space along with nutrients which was not observed in case of dual culture with *Fusarium solani*.

The antagonistic effect of these fungal bioagents against *M. phaseolina* was probably due to nutrient competition and / or antibiosis and / or degradation of cell wall by enzymes (Kumar, 2013). *Trichoderma spp.* produces numerous volatile secondary metabolites such as aldehydes, ethylene, ketones and, hydrogen cyanide which given an essential contribution in control of several plant pathogens (Vey *et al.,* 2001).

Table.1 List of tested *Trichoderma species* against *M. Phaseolina* using dual culture technique

Tr. No.	Antagonists
T1	*Trichoderma harzianum*
T2	*Trichoderma hamatum*
T3	*Trichoderma gliocladium*
T4	*Trichoderma asperellum*
T5	*Trichoderma viride*
T6	*Trichoderma virens*
T7	*Trichoderma koningii*
T8	Control (Test pathogen only)

Table.2 *In-vitro* antagonistic activity of different *Trichoderma spp.* against *M. Phaseolina*

Tr. No.	Bio-agents	Growth Inhibition (%)
T1	*Trichoderma harzianum*	22.96
T2	*Trichoderma hamatum*	54.81
T3	*Trichoderma gliocladium*	28.15
T4	*Trichoderma asperellum*	77.04
T5	*Trichoderma viride*	0.74
T6	*Trichoderma virens*	22.22
T7	*Trichoderma koningii*	23.70
T8	Control (Test pathogen only)	0.00
S.Em. ±		0.84
C.D		2.55
CV%		4.43

Fig.1

References

Abdel-lateif, K. S., & Bakr, R. A. (2018). Internal transcribed spacers (ITS) based identification of Trichoderma isolates and biocontrol activity against *Macrophomina phaseolina*, *Aspergillus niger* and *Meloidogyne incognita*. *African Journal of microbiology research*, 12(30), 715-722.

Anis, M., W. Abbasi and M. J. Zaki (2010). Bioefficacy of microbial antagonists against *Macrophomina phaseolina* on sunflower. *Pak. J. Bot*., 42: 2935-2940.

Anonymous, (2019). Indian Horticulture Database. Department of Agriculture and Co-operation (www.nhb.gov.in) accessed on 1 Feb 2022.

Arya, P., S. L. Godara, Bimla and A. Jat (2017). Efficacy of antagonists against *Macrophomina phaseolina* inciting dry root rot disease of groundnut. *Pharmacogn Phytochem*., 6(6): 1171-1173.

Cook, R. J. and K. F. Baker (1983). The Nature and

Practice of Biological Control of Plant Pathogens. Amer. *Phytopathol. Soc. St. Paul*, Minnesota. 539.

De Candolle, A. P. (1815). Memoire surles *rhizoctones* nouveau genre de champignons qui attaque les racines des plantes et en particulier celle de la luzerne cutivee. *Mémoires du Museum national d'histoire naturelle Série C Géologie* 2:209-216.

Dennis, C., & Webster, J. (1971). Antagonistic properties of species-groups of Trichoderma: I. Production of non-volatile antibiotics. *Transactions of the British Mycological Society*, 57(1), 25-IN3.

Ehteshamul-Haque, S., Abid, M., Sultana, V., Ara, J., & Ghaffar, A. (1996). Use of organic amendments on the efficacy of biocontrol agents in the control of root rot and root knot disease complex of okra. *Nematologia Mediterranea*, 24(1), 13-16.

Ganeshamoorthi, P., T. Anand and A. Saravanan (2010). Cultural and genetic variability in *Macrophomina phaseolina* (Tassi.) Goid and incidence of mulberry root rot. Arc. *Phytopathol Pfl*., 20: 123-132.

Gupta, K. N., K. R. Naik and Bisen (2018). Status of sesame diseases and their integrated management using indigenous practices. *International Journal of Chemical Studies*., 6(2): 1945-1952.

Harman, G. E., R. Petzoldt, A. Comis and J. Chen (2004). Interactions between *Trichoderma harzianum* strain T22 and maize inbred line Mo17 and effects of this interaction on diseases caused by *Pythium ultimum* and *Colletotrichum graminicola*. *Phytopathology*., 94: 147-53.

Huang, X. P., Huang, L. M., & Yue, W. Z. (2003). The characteristics of nutrients and eutrophication in the Pearl River estuary, South China. *Marine pollution bulletin*, 47(1-6), 30-36.

Jha, A. K. and Dubey, S. C. (2000). Occurrence of collar rot of okra (*Abelmoschus esculentus*) in the plateau region of Bihar. *Journal of Research*. 12(1):67-72.

Kumar M, Gaur V K, Kant K, Sharma A. Host range and pathogenic variation in isolates of *Macrophomina phaseolina* incident of dry root rot in Moth bean. *Annals of Plant Protection Sciences*. 2013; 21(2):333-336.

Manjunatha, S. V., M. K. Naik, M. R. F. Khan and R. S. Goswami (2013). Evaluation of bio-control agents for management of dry root rot of chickpea caused by *Macrophomina phaseolina*. *Crop Protection*., 45: 147 -150

Mohiddin, F. A., M. R. Khan, S. M. Khan and B. H. Bhat (2010). Why Trichoderma is considered super hero (super fungus) against the evil parasities. *Plant Pathol. J.*,9: 92- 102.

Pan, S. Bhagat (2008). Characterization of antagonistic potential of *Trichoderma sp* against some soil-borne plant pathogens. *J. Biol. Control.*,22: 43-49.

Parmar and Patel. 2020. Efficacy of bioagents against *Macrophomina phaseolina* causing root rot of soybean in vitro. Journal of Pharmacognosy and Phytochemistry. SP6: 196-198.

Pastrana, A. M., Basallote-Ureba, M. J., Aguado, A., Akdi, K., & Capote, N. (2016). Biological control of strawberry soil-borne pathogens *Macrophomina phaseolina* and *Fusarium solani*, using *Trichoderma asperellum* and Bacillus spp. *Phytopathologia mediterranea*, 109-120.

Parveen, S. H. A. H. I. D. A., Ehteshamul-Haque, S., & Ghaffar, A. B. D. U. L. (1994). Biological control of soilborne root infecting fungi in tomato and okra. *Pakistan journal of Botany*, 26, 181-181.

Sultana, V., S. Ehteshamul-Haque, J. Ara and M. Athar. 2005. Comparative efficacy of brown, green and red seaweeds in the control of root infecting fungi of okra. *Int. J. Environ. Sci. Tech.*, 2: 129-132.

Thombre, B. B. and O. D. Kohire (2018). In vitro bio-efficacy of bioagents and botanicals against Macrophomina blight of mungbean caused by *Macrophomina phaseolina* (Tassi) Goid. *Internat. J. Chem. Stud*., 6(2): 3063-3066.

Verma, O. P.; Singh, N. and Sharma, P. (2006). First report of *Rhizoctonia solani* causing leaf spot of *Adhatoda vasica.New Disease Reports*. 14:39.

Vey A, Hoagland R E, Butt T M. Toxic metabolites of fungal biocontrol agents, p: 311-346. In: "*Fungi as biocontrol agents: Progress, Problems and Potential*" (T. M. Butt, C. Jackson, N. Magan, eds.). CAB International, Bristol, UK, 2001, 390p.

Vinale, F., E. L. Ghisalberti, K. Sivasithamparam, R. Marra, A. Ritieni, R. Ferracane, S. Woo and M. Lorito (2009). Factors affecting the production of *Trichoderma harzianum* secondary metabolites during the interaction with different plant pathogens. *Lett. Appl. Microbiol.*, 48: 705-711.

Vincent, J. M. (1947). Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, 159(4051), 850-850.

Yadav, S. K., & Dhankhar, B. S. (2001). Correlation studies between various field parameters and seed quality traits in okra cv. Varsha Uphar. *Seed research-New Delhi-*, 29(1), 84-88.

How to cite this article:

Rishit Bhojani and Hemangi Kapadiya. 2022. Antagonistic Activity of Some *Trichoderma* Species against *Macrophomina phaseolina* causing Okra Root Rot. *Int.J.Curr.Microbiol.App.Sci.* 11(02): 245-250.
doi: https://doi.org/10.20546/ijcmas.2022.1102.026