Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 751-753
Received: 18-03-2020
Accepted: 22-04-2020

Diksha Nayak
Department of Plant Pathology, College of Agriculture, OUAT, Bhubaneswar, Odisha, India

MK Mishra
Department of Plant Pathology, College of Agriculture, OUAT, Bhubaneswar, Odisha, India

Bipin Pradhan
AICRP on fruits, OUAT, Bhubaneswar, Odisha, India

Kishan Kumar Sharma
Department of Plant Pathology, College of Agriculture, IGKV, Raipur, Chhattisgarh, India

Corresponding Author:
Diksha Nayak
Department of Plant Pathology, College of Agriculture, OUAT, Bhubaneswar, Odisha, India

Evaluation of some bio-control agents in *in vitro* control of *Fusarium oxysporum* f. sp. *cubense*, an incitant of banana panama wilt

Diksha Nayak, MK Mishra, Bipin Pradhan and Kishan Kumar Sharma

Abstract
Fusarium wilt of banana popularly known as Panama disease, is a lethal fungal disease caused by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense* (*Foc*) and is one of the most widespread and destructive banana diseases. Present study was taken up to evaluate efficiency of biocontrol agents against banana fusarium wilt to include in integrate disease management strategy as it is eco-friendly technique. The causal organism of panama wilt was tested along with various fungal and bacterial bioagents in dual culture method for testing the efficacy. Results revealed that *Trichoderma viride* reduced 84.1% radial growth of the causal pathogen followed by *Trichoderma harzianum*(82.2%) and *Trichoderma hamatum*(80.1%) while *Pseudomonas fluorescens* inhibited lowest radial growth (63.08%).

Keywords: Panama wilt, bio-control, eco-friendly, Integrated disease management

Introduction
Bananas are the unsung heroes of the fruit world. Dan Koeppel, author of *Banana: The Fate of the Fruit That Changed the World*, calls bananas "one of the most intriguing organisms on earth" Fusarium wilt of banana, popularly known as Panama disease, is a lethal fungal disease caused by the soil-borne fungus *Fusarium oxysporum* f. sp. *cubense* (*Foc*). (Foc) is recognised as one of the most widespread and destructive banana diseases, and a major production constraint to banana worldwide. Fusarium wilt of banana is a typical vascular wilt disease. The pathogen infects roots of susceptible and resistant banana cultivars, but infection generally progresses into vascular portions of the rhizome only in susceptible genotypes. The pathogen can survive in the soil for several decades by producing spores (specifically, chlamydospores), which will re-infect the susceptible banana plants (Stover, 1962) [12]. This adds to the difficulty of disease management.
Biological control has gained great interest in the last years in many pathosystems, including *Foc*/banana. This has been mainly due to the large input of pesticides, which cause economic, environmental and safety concerns. Biological control must not be a strategy limited to organic farming, but included within integrated disease management frameworks implemented in agricultural systems. Present investigation was taken up to evaluate efficiency of bio control agents against banana fusarium wilt to include in integrate disease management strategy.

Martials and Methods
Four bio-control agents *Trichoderma harzianum*, *Trichoderma viride*, *Trichoderma hematum and Pseudomonas fluorescens* were tested against *Fusarium oxysporum f. sp cubense*. Both biocontrol agents and test fungus were cultured on potato dextrose agar in order to get fresh and active growth of each fungus. Twenty ml of sterilized and cooled potato dextrose agar was poured into sterile petriplates and allowed to solidify. For evaluation of fungal biocontrol agent, mycelial discs of test fungus were inoculated at one end of Petriplate and antagonistic fungus was placed opposite to it on the other end at a distance of 5 mm from the periphery. In case of evaluation of bacterial antagonist the bacterium was streaked at ends of the Petriplates and mycelial discs of the fungus was placed at the centre. Four replications were maintained for each treatment. The plates were incubated at 27 ± 1 ºC and zone of inhibition was recorded by measuring the clear distance between the margin of the test fungus and antagonistic organism. The colony diameter of pathogen in control plate was also recorded. The per cent inhibition of the growth of the pathogen was calculated by using the formula suggested by Vincent (1947) [13].

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

Where
I = Per cent inhibition
C = Radial growth in control
T = Radial growth in treatment

Further, angular transformations were made for data and analysed statistically.

Result and Discussion

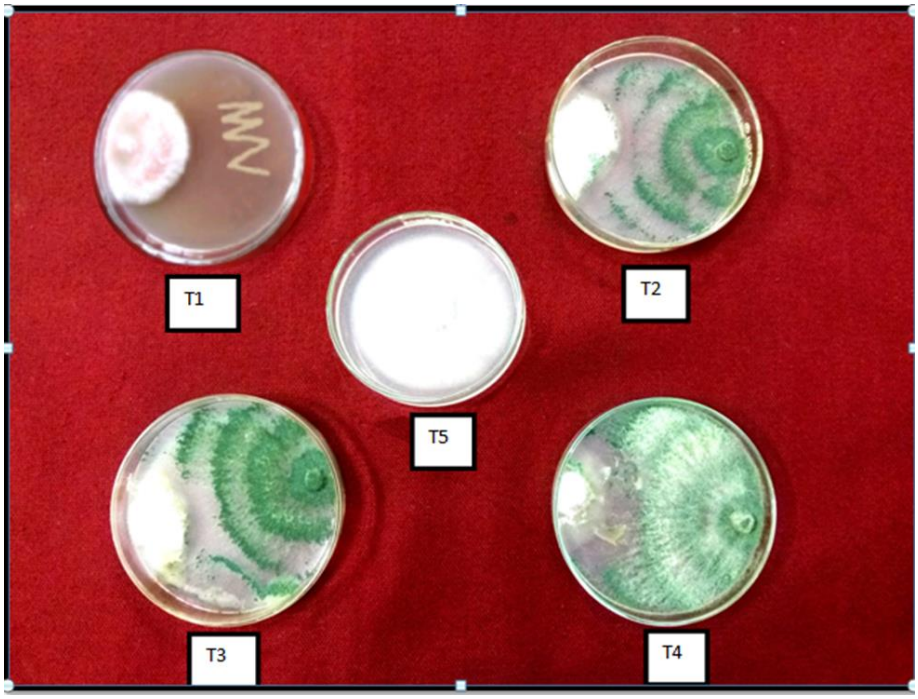
Efficacy of different bioagents against radial growth of *Fusarium oxysporum f. sp cubense*

Fusarium oxysporum f. sp cubense (Foc) was grown alone and in combination with fungal and bacterial bioagents for determining the efficacy of bioagents. *Trichoderma viride*, *Trichoderma harzianum* and *Trichoderma hamatum* reduced more than 80% radial growth of causal pathogen and were significantly superior from bacterial bioagents i.e. *Pseudomonas fluorescens*. It only controlled the radial growth upto 63% but all the bioagents were significantly superior over control.

Table 1: Effect of antagonists against the pathogen *in vitro*

Treatments	Biocontrol agents	Mean radial growth (mm)	Percent inhibition
T_1	*Trichoderma viride*	13.7	84.1
T_2	*Trichoderma harzianum*	15.25	82.2
T_3	*Trichoderma hamatum*	16.75	80.1
T_4	*Pseudomonas fluorescens*	31.75	63.08
T5	Control	86	0
SEm ±		0.81	
CD at 5%		2.51	

The causal organism of panama wilt was tested along with various fungal and bacterial bioagents in dual culture method for testing the efficacy. All the three isolates of *Trichoderma* reduced more than 80% of radial growth of the causal pathogen significantly in comparison to *Pseudomonas fluorescens* which control 63.08% radial growth. *In vitro* study conducted by Aeshah Mhana Mohammed *et al.* (2011) [1] showed *Pseudomonas fluorescens* clearly inhibiting the growth of *Fusarium oxysporum f.sp cubense(Foc)*. Chawla and Gangopadhyay. (2009) [3] reported maximum inhibition of *Fusarium oxysporum f.sp cumini* by *Pseudomonas fluorescens* (84.2%) followed by *Trichoderma harzianum* (81.9%). In contrary to this *Pseudomonas fluorescens* was less effective in comparison to *Trichoderma* isolates in the current study. Rani *et al.* (2009) reported maximum growth reduction by indigenous *Trichoderma viride* followed by other isolates of *Trichoderma* in reducing mycelial growth of *Fusarium* wilt of chilli. It can be suggested that different f.sp. of *Fusarium oxysporum* reacted differently against fungal and bacterial bio-agent which was supplemented also by Ram and Pandey. (2011) [9] with *Trichoderma viride* completely inhibiting the mycelial growth of *Fusarium oxysporum f.sp udum* better than *Pseudomonas fluorescens* and *Pseudomonas aeruginosa.*



Treatments
T1: *Pseudomonas fluorescens*
T2: *Trichoderma viride*
T3: *Trichoderma harzianum*
T4: *Trichoderma hamatum*
T5: Control

Plate 1: Effect of antagonists against the pathogen *in vitro*

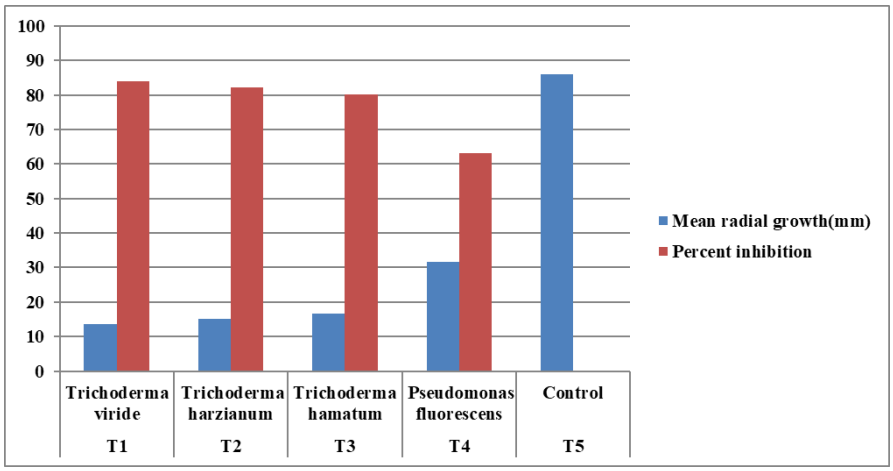


Fig 1: Effect of antagonists against *R. solani in vitro*

Conclusion

Trichoderma viride reduced 84.1% radial growth of the causal pathogen followed by *Trichoderma harzianum*(82.2%) and *Trichoderma hamatum*(80.1%). *Pseudomonas fluorescens* inhibited lowest radial growth (63.08%).

References

1. Aeshah Mhana Mohammed, Laith KT, AL-Ani, Lyazzat Bekbayeva, Baharuddin Salleh. Biological Control of *Fusarium oxysporum* f. sp. cubense by Pseudomonas fluorescens and BABA *in vitro*, World Applied Sciences Journal. 2011; 15(2):189-191.
2. Akila R, Rajendran L, Harish S, Saveetha K, Raguchander T, Samiyappan R. Combined application of botanical formulations and biocontrol agents for the management of *Fusarium oxysporum* f. sp. cubense (FOC) causing Fusarium wilt in banana. Biological Control. 2011; 57:175-183.
3. Chawla N, Gangopadhyay S. Integration of organic amendments and bioagents in suppressing cumin wilt caused by *Fusarium oxysporum* f. sp. cumini. Indian Phytopathlogy. 2009; 62(2):209-216.
4. Mohandas S, Manjula R, Rawal RD, Lakshmikantha HC, Chakraborty S, Ramachandra YL. Evaluation of arbuscular mycorrhiza and other biocontrol agents in managing *Fusarium oxysporum* f. sp. cubense infection in banana cv. Neypoovan. Biocontrol Science and Technology. 2010; 20(2):165-181.
5. Nel B, Steinberg C, Labuschagne N, Viljoen A. The potential of nonpathogenic *Fusarium oxysporum* and other biological control organisms for suppressing Fusarium wilt of banana. Plant Pathology. 2006; 55:217-223.
6. Nel B. Management of Fusarium wilt of banana by means of biological and chemical control and induced resistance [MSc thesis]. Pretoria: University of Pretoria, 2004.
7. Ploetz RC, Churchill ACL. Fusarium wilt: the banana disease that refuses to go away. In: Van den Bergh, I., Smith, M., Swennen, R. and Hermanto, C. (Eds.). Proceedings of International ISHSProMusa Symposium on Global Perspectives on Asian Challenges, 2011.
8. Raghuchander T, Jayashree K, Samiyappan R. Management of Fusarium wilt of banana using antagonistic microorganisms. Journal of Biological Control. 1997; 11:101–105.
9. Ram H, Pandey N. Efficacy of bio-control agents and fungicides in the management of wilt of pigeon pea. Indian Phytopathology. 2011; 64(3):269-271.
10. Rujappan K, Vidhyasekaran P, Sethuraman K, Baskaran TL. Development of powder and capsule formulations of Pseudomonas fluorescens strain Pf-1 for control of banana wilt. Z. Pflanzenk. Pflanzen. Journal of Plant Diseases and Protection. 2002; 109:80-87.
11. Saravanan T, Muthusamy M, Marimuthu T. Effect of Pseudomonas fluorescens of Fusarium wilt pathogen in banana rhizosphere. Journal of Biological Science. 2004; 4(2):192-198.
12. Stover RH. Fusarial Wilt (Panama Disease) of Bananas and Other Musa Species. Kew, UK: Commonwealth Mycological Institute, 1962.
13. Vincent JM. Distribution of fungal hyphae in the presence of certain inhibitors. Nature. 1947; 159:850.