Biological Forum – An International Journal **15(10): 1498-1500(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Bioefficacy of Bioagents Against *Sarocladium oryzae*

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(Received: 24 August 2023; Revised: 29 September 2023; Accepted: 08 October 2023; Published: 15 October 2023)
(Published by Research Trend)

ABSTRACT: Sheath rot disease of rice (*Sarocladium oryzae*) has become a consequential production constraint in all rice growing countries. The pathogen was isolated from the sheath rot infected rice plants. The antagonistic potential of the bioagents were tested against *S. oryzae* under laboratory condition. The outcomes of the experiments unveiled that among the bio-agents tested, *Pseudomonas fluorescens* (BGREB73) was found to be more effective and statistically significant over other bio-control agents in inhibiting mycelial growth (87.20%) followed by *T. harzianum* (T-13) (84.12%) in dual culture over the control.

Keywords: Rice, sheath rot, *Sarocladium oryzae*, bioagents.

INTRODUCTION

Sheath rot, caused by *Sarocladium oryzae* (Sawada) Gams and Hawksworth has gained the status of a major disease of rice and yield loss varies from 10 to 85% (Sakthivel, 2001). The fungus is detected frequently during routine seed health testing and causes empty grain production (Kulwanth and Mathur 1992) and glume discolouration (Sachan and Agarwal 1995) and also seed discolouration (Reddy *et al*., 2000). It also causes poor grain filling and reduction in seed germination (Vidhyasekaran *et al*., 1984). Seeds from infected panicles became discoloured and sterile (Mew and Gonzales 2002).

Although chemical sprays offers reasonable management disease but now their diverse harmful effects are well cited. In recent times, a change has gradually taken place with respect to the perception of priorities. Under this concept, bio-antagonists or biological control agents offers a great promise and thus given priority over chemical control. Biocontrol are playing pivotal role in reducing yield losses. Therefore, in this study, the work was done to identify potential biocontrol agent that may manage sheath rot of rice caused by *S. oryzae*.

MATERIAL AND METHODS

Dual culture test. In the present studies four bio-agents *viz*., *Trichoderma viride* (Ta-1), *Trichoderma harzianum* (T-13), *Bacillus subtilis* (SE76) and *Pseudomonas fluorescens* (BGREB73) were evaluated for their efficacy through dual culture technique at the laboratory of Department of Plant Pathology, College of Agriculture, Raichur. The bio-agents and the test pathogen were inoculated in the periphery in an opposite direction of the 70 mm diameter Petri plate containing solidified PDA medium. Whereas, the bacterial bio-agents were streaked. Three replications were maintained and one control by maintaining pathogen and bio-agent alone and incubated for 15 days. The colony diameter of both the bio-agents and the pathogen was measured in both directions and the average was recorded. Per cent inhibition growth of the test pathogen was calculated by using the formula given below by Vincent (1947). The bio-agents used doe bio-efficacy studies are listed in Table 1.

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

Where,
I = Per cent inhibition
C = Growth in control
T = Growth in treatment

Table 1: List of bioagents used for bioefficacy against *S. oryzae* in *in vitro*.

Sl. No.	Bioagents	Isolate
1	*Trichoderma viride*	Ta-1
2	*Trichoderma harzianum*	T-13
3	*Bacillus subtilis*	SE76
4	*Pseudomonas fluorescens*	BGREB73

RESULTS AND DISCUSSION

The chemicals are spectacular, impressive, quick and convincing even to a farmer, but there is an intensified worldwide concern about environmental pollution due to escalated use of hazardous pesticides including fungicides also. A multitude of microbes has been implicated to be biocontrol agents of the plant pathogen, sometimes with excellent documentation. Hence studies were conducted to find out an effective biocontrol agent against *S. oryzae* and to develop a biocontrol technique as a feasible component in the present-day integrated disease management (IDM) strategy.

In the present investigations, four bio-agents were tested for the ability on the inhibition of colony diameter of *S. oryzae* through dual culture (Table 2). Among the bio-agents tested, *Pseudomonas fluorescens* (BGREB73) was found to be more effective and statistically significant over other treatments in inhibiting the colony diameter (87.20%) which was followed by *T. harzianum* (T-13) (84.12%). However, the minimum mycelial inhibition was recorded in *B. subtilis* (SE76) (76.01%) (Plate 1).

Among bacterial antagonists, *P. fluorescens* showed maximum inhibition. The mechanism involved in the inhibition of growth might be due to the agglutination potential of *P. fluorescens* and also antibiotics *viz*., siderophore, HCN, pyrrolnitrin, phenazine and 2, 4-diacetyl phloroglucinol and lytic enzymes by *P. fluorescens* might have inhibited the mycelial growth of *S. oryzae*. Mechanisms for bio-control of plant pathogens by *Trichoderma* are through antibiosis, competition and mycoparasitism. In the present study, *T. harzianum* suppressed the growth of *S. oryzae* and that might be due to the mutual intermingling of antagonistic isolate with the test pathogen.

Similar work was done by Elad *et al.* (1981), who reported that antibiosis, lysis and disintegration of mycelium of test fungus due to action of enzymes produced by *Trichoderma* spp. Kumar and Patibanda (2015) revealed that antagonistic effect of the fungal and bacterial bioagents on the growth of *S. oryzae* was studied under *in vitro* using dual culture technique. Among them *T. harzianum* showed maximum inhibition against *S. oryzae* (83.26 %) followed by *T. viride* (78.67 %) and among bacterial antagonist *Bacillus subtilis* showed maximum inhibition against the *S. oryzae* (75.35 %) followed by *Pseudomonas fluorescens* (67.40 %).

Various species of *Pseudomonas, Trichoderma* and *Bacillus* are the most commercially exploited bio-agents / antagonists to combat several seed-borne and soil-borne plant pathogens. Fungicidal / fungistatic effects of these bio-agents have been attributed to various mechanisms exerted such as antibiosis, lysis, mycoparasitism, competition, production of volatile/non-volatile compounds, *etc*. In the present study, different species of *Pseudomonas* and *Trichoderma* were found as an efficient antagonist against *Sarocladium* infecting sheath rot.

Table 2: Bio efficacy of bioagents against *Sarocladium oryzae.*

Sr. No.	Bioagent	Isolate	Inhibition of mycelial growth over control (%)
1	*Pseudomonas fluorescens*	BGREB73	87.20(69.04)*
2	*Bacillus subtilis*	SE76	76.01(60.67)
3	*Trichoderma harzianum*	T-13	84.12(66.52)
4	*Trichoderma viride*	Ta-1	77.99(62.02)
	Mean	**81.33**	
	S. Em±	**0.43**	
	CD @1%	**2.01**	

*Figures in parenthesis are arc sine values

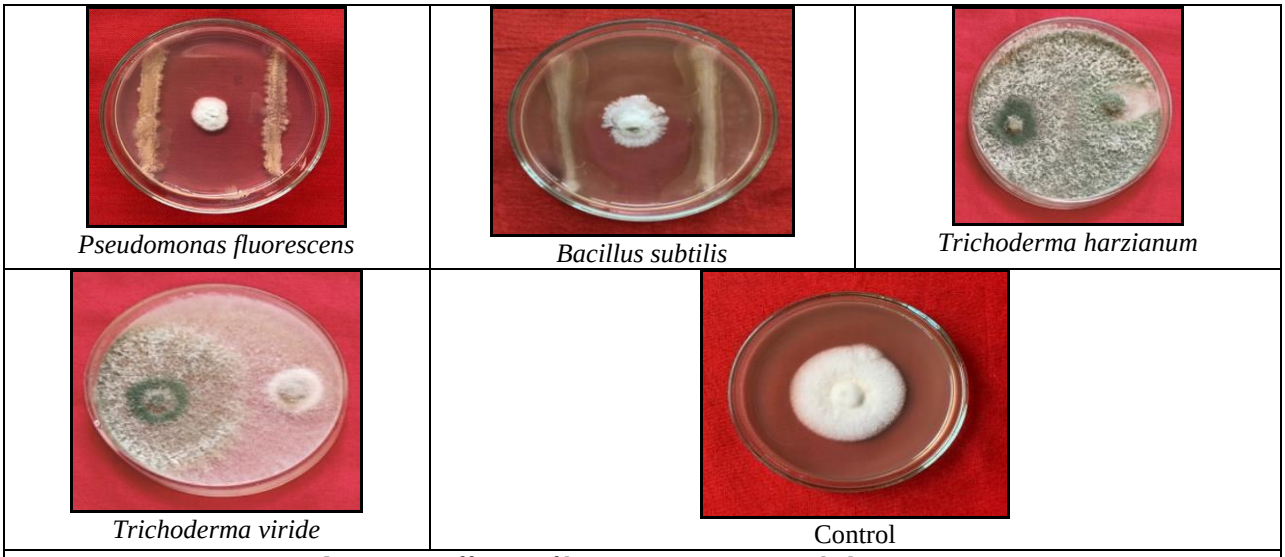

Plate 1. Bio efficacy of bioagents against *Sarocladium oryzae*.

CONCLUSIONS

Among all the bio-agents tested *Pseudomonas fluorescens* (BGREB73) stood out as being more potent and statistically significant in comparison to other bio-control agents with maximum per cent inhibition of 87.20 per cent.

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How to cite this article: Soundarya Nayak, Gowdar S.B., Ashwathanarayana D.S., Amaresh Y.S. and Badariprasad P.R. (2023). Bioefficacy of Bioagents Against *Sarocladium oryzae*. *Biological Forum – An International Journal*, *15*(10): 1498-1500.