Evaluation of Biocontrol agents *in vitro* against *Fusarium oxysporum* causing Fusarium rot of Pleurotus spp.

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Abstract- *In vitro* evaluation of Bioagents against both *Fusarium oxysporum* and *Pleurotus sajor-caju* revealed that all the bioagents more or less suppress the growth of *Fusarium oxysporum.* Out of six bioagents, *Bacillus subtilis*-115 expressed the efficient antagonistic activity against *Fusarium oxysporum* followed by *P. flourescens*-105, *P. flourescens*- 104 and *P. flourescens*-103. Among these bioagents tested *P. flourescens*-103 revealed more inhibitory effect against pathogen but also inhibited the mycelial growth of *Pleurotus sajor-caju* strongly. The bioagents *Bacillus subtilis*-115, *P. flourescens*-105 and *P. flourescens*-104 revealed less antagonistic activity against *P. sajor-caju* but their inhibitory effect against the pathogen was very strong.

Index Terms- pleurotus, Fusarium oxysporum, biological control agents

I. Introduction

Fusarium rot is reported to be devastating disease in the crop production of mushrooms. It is occurring in almost all countries of world, where cultivation of this crop is in practice including India. It is also commonly occurring in mushroom houses in the Kashmir valley number of workers have recommended fungicidal treatment for management of this disease but growers are reluctant to use these chemicals as they inhabit the growth of the *Pleurotus* mycelium also (Rai and Vijay, 1992) and are non economical and results in environmental pollution. The present studies will be carried out to develop economically viable and eco-friendly management of this devastating disease of *Pleurotus* spp.

II. Materials and methods

Various bioagents were evaluated against *Pleurotus sajor-caju* and *Fusarium oxysporum.* The antagonists in this study were *Pseudomonas flourescens* isolate-103, *Pseudomonas flourescens* isolate-104, *Pseudomonas flourescens* isolate-105, *Bacillus subtilis* isolate-115, *Bacillus subtilis* isolate-116 and *Azospirillim*. Pure cultures of all these above mentioned microorganisms were procured from department of MRTC, SKUAST-Kashmir, Srinagar. All these bioagents were then tested for their antagonistic activity against both *Pleurotus sajor-caju* and *Fusarium oxysporum*. The culture discs of 5 mm size of each of the antagonists and the pathogen (*Fusarium oxysporum*) and *Pleurotus sajor-caju* taken from the margins of 7 days old cultures were aseptically transferred to solidified PDA on the opposite side (5 cm) apart in petriplates (9 cm). The petriplates having pathogen (*Fusarium oxysporum*) and *Pleurotus sajor-caju* separately served as control. The petriplates were incubated at 26 ± 1° C, till the complete growth was observed in control plates. Colony diameter of the *Fusarium oxysporum* and *Pleurotus sajor-caju* were recorded and percent growth inhibition over control was calculated according to the formula given by Vincent (1947).

$$\text{Mycelial inhibition} = \frac{\text{Radial growth in control} - \text{Radial growth in treatment}}{\text{Radial growth in control}} \times 100$$

III. Results and Discussion

Data presented in the (Table 1) reveals that all bioagents more or less significantly, inhibited the mycelial growth of *Fusarium oxysporum* causing *Fusarium* rot in Dhingri (*P. sajor-caju*) mushroom .out of six bioagents tested, *Bacillus subtilis* 115 was most effective against *Fusarium oxysporum*, reduced the radial growth of *Fusarium oxysporum* by (66.65%) followed by *Pseudomonas* 105 (63.32%). It was followed by *Pseudomonas* 104 (62.21%). The maximum percent inhibition in radial growth of *Fusarium oxysporum* (49.25%) was observed in *Bacillus subtilis* 116 followed by *Azospirillim* (44.80%). The maximum percent inhibition of *P. sajor-caju* (63.69%) was exhibited by *Pseudomonas* 103 (Table 2). It was followed by *Azospirillim* (62.21%) followed by *Pseudomonas* 104 (58.51%) and *Bacillus subtilis* 116 (57.77%). *Pseudomonas* 105 show minimum inhibition of mycelial growth of *P. sajor-caju* (49.25%) followed by *Bacillus subtilis* 115 (52.95%), but showed high antagonistic property against pathogen (*Fusarium oxysporum*). None of the bioagents were able to cause complete inhibition of *Fusarium oxysporum*. *Pseudomonas* 104, *Pseudomonas* 105 and *Bacillus subtilis* were selected for *in vivo* trail, as all of them show good antagonistic effect on *Fusarium oxysporum* and least inhibition of *P. sajor-caju* in comparison to other bioagents (Plate-8 and 9). The mode of antagonisim observed with *Bacillus* spp. is antibiosis (Edward *et al*. 1994). Cho *et al.* (2002) reported the antagonistic activity of fluorescent *Pseudomonas* spp. against *Pleurotus ostreatus* (Bhanwar and Thakur, 2004) studied the effect of *Azospirillim*, *Azatobacter*, *Bacillus Polymixa* and *Pseudomonas straita* on vegetative growth and yield of oyster mushroom (*P. sajor-caju*).

This is supported by reports that most *Bacillus* spp. Produced many antibiotics such as bacillomycin, fengycin, mycosubtilin and zwittermicin, which are all effective in suppressing growth of pathogen both *in vitro* and *in vivo* (Pal and Gardener, 2006).

Table-1 : *In vitro* evaluation of bioagents against *Fusarium oxysporum* the causal agent of *Fusarium* rot disease of *Pleurotus sajor-caju*

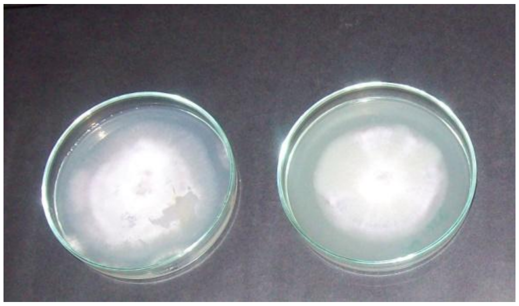
Concentration	Per cent inhibition of mycelial growth over control				
Bioagents	**R_1**	**R_2**	**R_3**	**Total**	**Mean**
P. flourescens-103	53.32	55.55%	61.10	169.9	56.65%
P. flourescens-104	55.55	63.32%	67.77	186.64	62.21%
P. flourescens- 105	61.10	64.43	64.43%	189.96	63.32%
Bacillus subtilis-115	61.10	66.66%	72.21	199.97	66.65%
Bacillus subtilis -116	45.55	48.88%	53.32	147.75	49.25%
Azospirillim	39.99	46.66%	47.77	134.42	44.80%

S.Em± =1.06
C.D @ 0.05%= 2.73

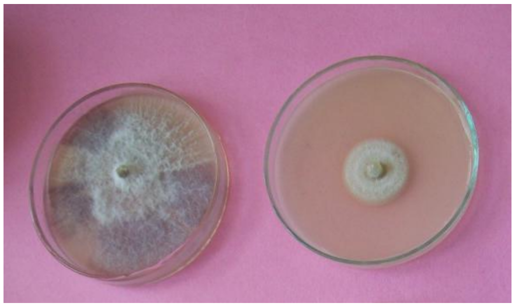
Table-2 : *In vitro* evaluation of bioagents against *Pleurotus sajor-caju*

Concentration	Per cent inhibition of mycelial growth over control				
Bioagents	**R_1**	**R_2**	**R_3**	**Total**	**Mean**
P. flourescens-103	61.10	63.32	66.66	191.08	63.69
P. flourescens-104	55.55	58.88	61.10	175.53	58.51
P. flourescens- 105	45.55	48.88	53.32	147.75	49.25
Bacillus subtilis-115	49.99	53.32	55.55	158.86	52.95
Bacillus subtilis -116	55.55	56.66	61.10	173.31	57.77
Azospirillim	55.55	63.32	67.77	186.64	62.21

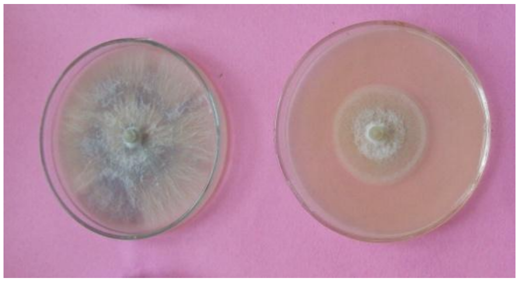
S.Em± =0.88
C.D @ 0.05%=2.29



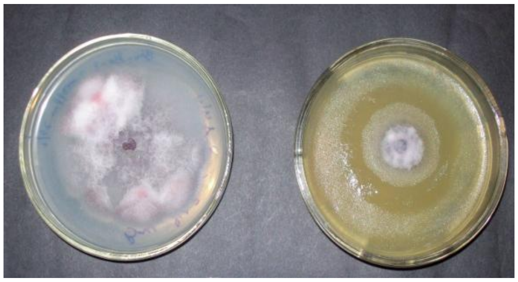
Azospirillim



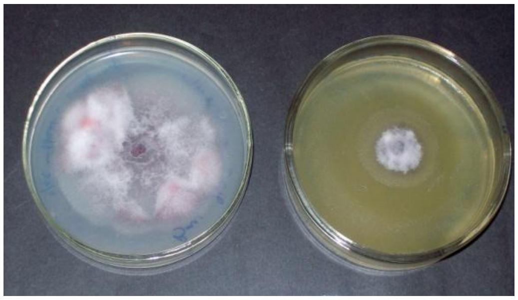
Bascillus subtilis 115



Bacillus subtilis 116



Pseudomonas flourescens 103



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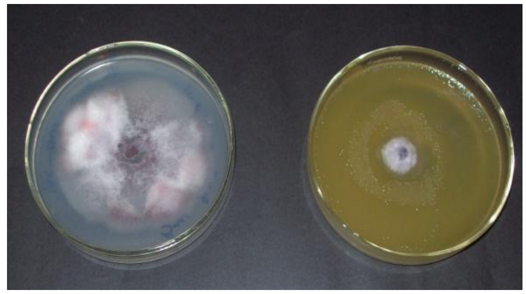

Pseudomonas flourescens 105

Plate-1 : Evaluation of bioagents against *Fusarium oxysporum*

Azospirillim

Bacillus subtilis 115

Bacillus subtilis 116

Pseudomonas flourescens 103

Pseudomonas flourescens 104

Pseudonomas *flourescens* 105

Plate-2 :Evaluation of bioagents against *Pleurotus sajor-caju*

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