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Purpureocillium sp.: A potential antagonist against different phytopathogens

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Abstract
The antagonistic activity of *Purpureocillium* sp. was tested against the phytopathoges by dual culture technique. In dual culture test, different soil borne phytopathoges was tested against *Purpureocillium* sp. and the maximum Per cent Growth Inhibition (PGI) was recorded in the case of *Pythium aphanidermatum* (77.78%) followed by *Fusarium moniliformae* (68.23%) and least per cent growth inhibition were recorded in *Sclerotium rolfsii* (58.89%).

Keywords: Antagonist, *Purpureocillium,* phytopathogen

Introduction

Biological control agents developed on the basis of mycelium and spores from fungi belonging to the genus *Purpureocillium* Pers. Ex Fr., under phylum Ascomycota, Class Eurotiomycetes Order Eurotioales has gained immense importance since last four to five decades due to its biological control ability against the nematodes and other soil-borne pathogens (Anusha, 2014) [1].

Ability of biocontrol agent to capture nematodes depends on development of structures by the fungal mycelia. The predacious fungus forms hyphal structures, such as adhesive hyphal nets, knobs, branches and constricting or non constricting rings and in which nematodes are captured mechanically or through adhesion. Fungal hypha then penetrates into the nematode and utilizes its content as a food. The nematode parasitic fungi on the other hand infect nematodes with their spores which either adhere to the surface of nematodes or are swallowed by them. Ultimately the result of nematode infection in any way is always the death of the host. *Purpureocillium* sp. a saprophytic soil fungus has drawn the attentions of many researchers due to its promising effect in parasitizing and controlling the population of phytonematodes and other soil borne pathogens. These species can grow at a wide range of temperatures from 8 °C to 30 °C with optimal growth in the range of 20° to 25 °C. It has a wide pH tolerance and can grow on a variety of substrates. *Purpureocillium* sp. has shown promising results as a bio control agent to control the growth of destructive root knot nematodes and other soil-borne pathogens (Anusha, 2014) [1].

Materials and Methods

1. *Fusarium oxysporum* (Wilt of banana),
2. *Pythium aphanidermatum* (Damping off of tomato),
3. *Sclerotium rolfsii* (Stem rot of Indian bean),
4. *Fusarium moniliformae* (Wilt of sugarcane),
5. *Macrophomina phaseolina* (Charcoal rot of groundnut),
6. *Fusarium oxysporum* f. sp. *vasinfectum* (Wilt of cotton)

The above cultures were obtained from the Department of Plant Pathology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) and maintained on PDA medium. The methodology for testing against the phytopathogens was followed as given by Pau *et al*., 2012 [4].

Dual culture technique (For fungal pathogens)

For interaction of each pathogen against *Purpureocillium* sp. sterilized Petri plates (9cm) were used. An autoclaved melted PDA was spread to make a thin PDA film in the Petri plates. After solidification of PDA in Petri plate, the 5mm discs of one week old growing colonies were cut from the margin of each pathogen and *Purpureocillium* sp. was placed on the opposite sides of the Petri plate 4cm apart on the PDA medium and was incubated at 25 ± 2ºC temperature.

After seven days the mycelium growth of test pathogens in treated and control plates was recorded. Per cent growth inhibition (PGI) of pathogens was calculated by using the following formula given by Pau *et al*., (2012) [4].

$$PGI = \frac{(DC-DT)}{DC} \times 100$$

Where,
PGI = Per cent Growth Inhibition
DC = Average diameter of colony in control set
DT = Average diameter of colony in treated set

Results and Discussion

Dual culture technique (For Fungal Pathogens)

The most potent *Purpureocillium* sp. isolate *i.e.* Siker (P-3) isolate of Tapi district was tested for its antagonistic effect against the different soil-borne pathogens *viz*.,

1. *Fusarium oxysporum* (Wilt of banana),
2. *Pythium aphanidermatum* (Damping off of tomato)
3. *Sclerotium rolfsii* (Stem rot of Indian bean),
4. *Fusarium moniliformae* (Wilt of sugarcane),
5. *Macrophomina phaseolina* (Charcoal rot of groundnut),
6. *Fusarium oxysporum* f. sp. *vasinfectum* (Wilt of cotton)

Purpureocillium sp. isolate showed significant inhibition against all the pathogens. The maximum per cent growth inhibition was recorded in *Pythium aphanidermatum* (77.78%), which was followed by *Fusarium moniliformae* (68.23%) and least per cent growth inhibition was recorded in case of *Sclerotium rolfsii* (58.89%) (Table 1 and Fig.1). Similar findings were shown by the research workers Hashem (2004) [2] isolated 31 fungal species from the soybean roots. The most dominant species were *Aspergillus flavus* Link., *F. oxysporum* Schlecht., *F. solani* Sacc., *Macrophomina phaseolina* (Tassi) Goid and *Rhizoctonia solani* J.G. Kuhn. Pathogenicity tests proved the ability of *M. phaseolina* and *R. solani* to infect soybean root and produce the symptoms of damping off and root rot diseases. The efficacy of *T. harzianum*, *Epicoccum nigrum* Link. and *P. lilacinus* was evaluated against pathogenic fungi. Bio-control fungi significantly suppressed *M. phaseolina* and *R. solani* under *in vitro* and *in vivo*. *E. nigrum* and *P. lilacinus* suppressed the growth of the pathogens by producing an inhibition zone. Perveen *et al*. (2015) [5] evaluated the different *Paecilomyces* sp. *viz*., *P. variotii* Bainier., *P. lilacinus* (Thom) Samson. and *P. fumosoroseus* Wize. under *in vitro* for biocontrol potential against *Sclerotium rolfsii* Sacc. and *Pythium aphanidermatum* Fitzp. by dual culture plate method. Colonies of *Paecilomyces* sp. and *S. rolfsii* met each other but *S. rolfsii* later overgrew the colonies of tested fungi whereas, the growth of *P. aphanidermatum* was inhibited by the *Paecilomyces* sp.

Table 1: *In vitro* microbial antagonism against *Purpureocillium* sp

Sr. No.	Test organism	Growth inhibition# %	Plate No.
1.	*Fusarium oxysporum*	63.75	9
2.	*Pythium aphanidermatum*	77.78	10
3.	*Sclerotium rolfsii*	58.89	11
4.	*Fusarium moniliformae*	68.23	12
5.	*Macrophomina phaseolina*	62.22	13
6.	*Fusarium oxysporum* f. sp. *vasinfectum*	65.55	14
S.Em. ±		1.11	
C.D. at 5%		3.33	
CV%		3.37	

\# Average of four repetitions

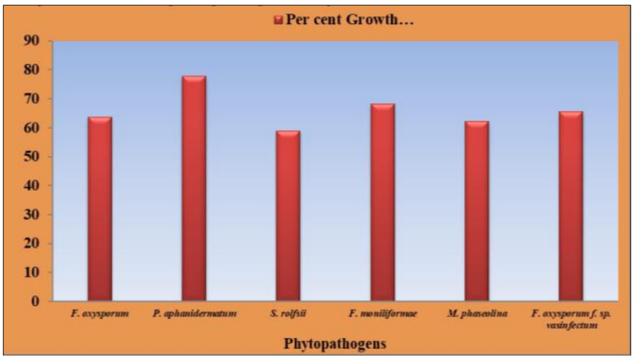

Fig 1: *In vitro* microbial antagonism against *Purpureocillium* sp.

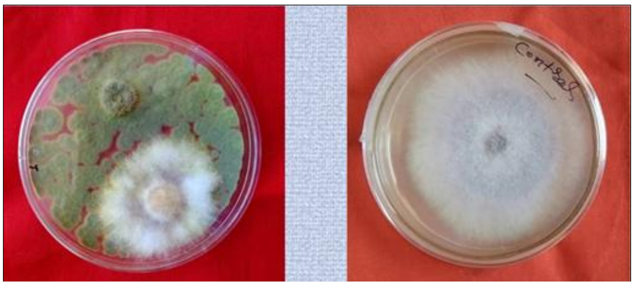

Plate 1: Antagonist effect of *Purpureocillium* sp. isolate against *Fusarium oxysporum* (Wilt of Banana)

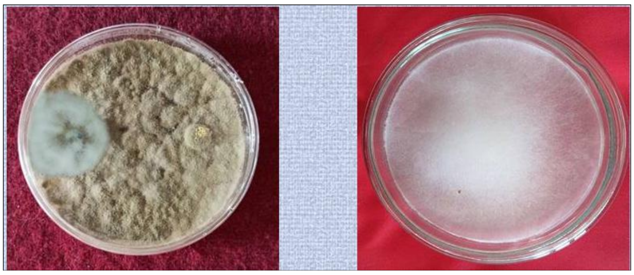

Plate 2: Antagonist effect of *Purpureocillium* sp. isolate against *Pythium aphanidermatum* (Damping off of Tomato)

Plate 2: Antagonist effect of *Purpureocillium* sp. isolate against *Sclerotium rolfsii* (Stem rot of Indian bean)

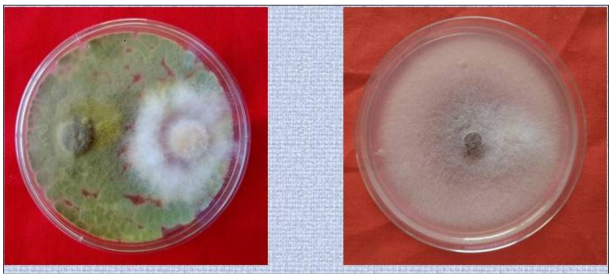

Plate 3: Antagonist effect of *Purpureocillium* sp. isolate against *Fusarium moniliformae* (Wilt of Sugarcane)

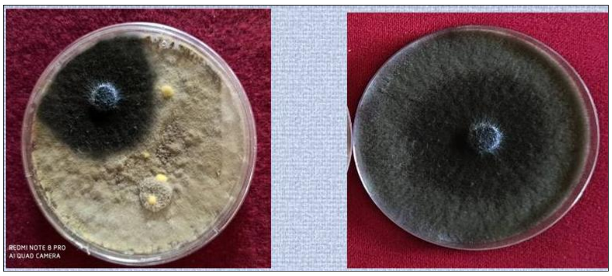

Plate 4: Antagonist effect of *Purpureocillium* sp. isolate against *Macrophomena phaseolina* (Charcoal rot of Groundnut)

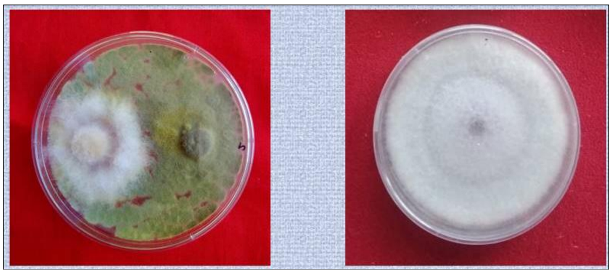

Plate 5: Antagonist effect of *Purpureocillium* sp. isolate against *Fusarium oxysporum* f. sp. vasinfectum (Wilt of Cotton)

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