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Antagonistic Activity of Potential Soil Fungi against *Bipolaris oryzae* (Breda de Haan)

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ABSTRACT

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Fungal phytopathogens are causes of many plant disease and maximum loss of crop yields, especially in tropical regions. Chemical fungicides are extensively used in agriculture. However, these products may cause problems such as environmental pollution and affect human health, microorganism particularly fungi as biocontrol agents have high potential to control plant disease and eco-friendly without side effect on the environments. In the present investigation suggests that the antagonistic activity of some potential soil fungi against brown leaf spot pathogen *Bipolaris oryzae* were studied in *in vitro* experiment. The maximum potential soil fungi showed the ability to inhibit the pathogen in a broad aspects and the mechanism of the interaction studies were discussed.

Introduction

Soil borne disease of rice may cause heavy losses to the crops at all stages of growth, seed germination, seedling and maturing plants (Harman 2000). Rice (*Oryza sativa* L.) is among the most important cereals in the world wide. On the basis of nutrition value, it is comparatively rated more than other cereals and plays a key role in nutrition (Alinia *et al.*, 2002). Rice brown leaf spot caused by *Bipolaris oryzae* Breda de Hann (formerly, *Helminthosporium oryzae*) (Teleomorph: *Cochliobolus miyabeanus*) is occurred in all rice-growing areas of the world. The pathogen causes infection on all growth stages of rice

plant from nursery to field and results in significant yield and grain quality losses. Rice brown leaf spot was a major factor for the Great Bengal Famine during 1942– 1943 (Ou, 1895). In 1956, the disease was reported by Petrak at the first time from some developed countries and then it was reported by Sharif and Ershad from coastal area of Caspian sea in 1966 (Ershad, 1995). The disease is prevalent in northern provinces countries and under environmental conditions conducive to disease; it can cause severe yield loss (Khosravi *et al.*, 2007 and Sivanesan, 1987).

Biocontrol of plant pathogen involves the use of biological processes to reduce the inoculum density of pathogen and to maintain these soil population below the disease threshold level. This reduces crop losses while interfering minimally with the ecosystem and damaging the environment. The pathogen in the absence of their hosts survive either as dormant propagules or actively as saprophytes on dead organic substrates of the host in the soil. Antagonist interactions have been recognized as the mechanisms of biological control (Khara and Hardwan, 1990, Tu 1992; Norik and Sen, 1992). Antagonism involves antibiosis, competition and exploitation process. In the present investigation suggests that the *B.oryzae* was studied in inter fungal interaction on the growth of the pathogen has been studied and discussed.

Materials and Methods

Studies on the interaction between *Bipolaris oryzae* and soil fungi

The test pathogen and the soil mycoflora were studied with dual culture plate technique under *invitro* condition. The test pathogen *Bipolaris oryzae* and the soil fungi viz, *Aspergillus awamori*, *A.flavus*, *a.niger*, *A.oryzae*, *A.sulphures*, *A.sydowi*, *Penicillium* sp, *P.citrinum*, *P.chrysogenum*, *T.harzianum* and *Trichoderma viride* were grown separately on PDA medium.

The agar blocks cut from actively growing margin of individual species of soil fungi and test organism were inoculated juxtaposed to each other approximately 3 cm apart on potato dextrose agar medium in petriplate. Three replicates for each set were maintained. Controls were set in single and dual inoculated cultures at the fungus. The position of the colony margin on the back of the disc was recorded daily.

Assessments were made when the fungi had achieved an equilibrium after which there was no further alteration in the growth. Since both of the organisms were naturally inhibited. The assessment was made for both organisms. The percentage inhibition of growth was calculated as follows.

$$\text{Percentage of inhibition of growth} = \frac{r-r^1}{r} \times 100$$

r = growth of the fungus from the centre of the colony towards the centre of the plate in the absence of antagonistic fungus. r^1 = growth of the fungus from the centre of the colony towards the antagonistic fungus. The colony interaction between test pathogen and soil fungi was proposed methods (Porter 2000, Skidmore and Dickinson 1976).

Results and Discussion

The prevalence of pathogenic fungi which are resistant to the nerves or modern antibiotics that have been produced in the last three decades. Fungi are responsible for the vast majority of plant disease. Biocontrol by microorganisms is a promising approach to control parasitic fungi. Microorganism such as fungi, virus and bacteria are recognized as biocontrol agents.

The test pathogen *Bipolaris oryzae* and soil fungi viz., *Aspergillus awamori*, *A.flavus*, *A.niger*, *A.oryzae*, *A.sulphures*, *A.sydowi*, *Penicillium* sp, *P.citrinum*, *P.chrysogenum*, *T.harzianum* and *Trichoderma viride* were maintained on potato dextrose agar medium.

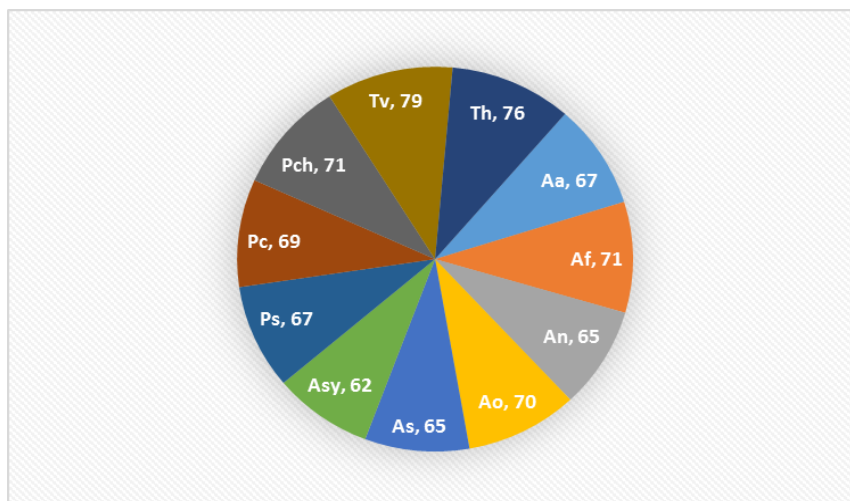
Trichoderma sp. possesses innate resistance to most agricultural chemicals, including fungicides, although individual strains differ in their resistance. Sometimes have been selected (or) modified to be resistant to specific agricultural chemicals.

Table.1 Colony interaction between *Bipolaris oryzae* and selected soil fungi in Dual culture experiments

S.No.	Growth response of the antagonistic and test fungus	Antagonistic fungi tested (Growth rate in mm)										
		<i>Aa</i>	<i>Af</i>	<i>An</i>	<i>Ao</i>	<i>As</i>	<i>Asy</i>	<i>Ps</i>	<i>Pc</i>	<i>Pch</i>	<i>Tv</i>	<i>Th</i>
1.	Colony growth of pathogen towards antagonist (r_1)	19.0	20.0	50.0	17.0	30.0	20.0	18.0	30.0	17.0	55.0	18.0
2.	Colony growth of pathogen away from the antagonist	21.0	24.5	55.0	18.5	37.0	24.0	22.0	35.0	21.0	59.0	20.0
3.	% growth inhibition of pathogen in the zone of interaction	67.0	71.0	65.0	70.0	65.0	62.0	67.0	69.0	71.0	79.0	76.0
4.	Colony growth of antagonist in control (ie) growth of the plate in absence of the pathogen. (r)	70.0	69.0	73.1	73.8	53.8	56.9	72.3	53.8	73.8	72.4	65.0
5.	Colony growth of antagonist towards the pathogen (r_1)	67.0	63.0	27.0	69.0	51.0	50.0	65.0	52.0	61.0	48.6	65.0
6.	Colony growth of antagonist away from the pathogen	58.0	58.0	19.0	56.0	45.0	41.0	51.0	43.0	49.0	18.3	45.0
7.	% of grow the inhibition in the zone interaction.	8.0	8.0	55.4	11.2	21.5	11.2	10.9	24.6	14.0	16.3	23.6

Aa-Aspergillus awamori, Af-A.flavus, An- A.niger, Ao- A.oryzae, As-A.sulphures, Asy-A.sydowi, Ps-Penicillium sp, Pc-P.citrinum, Pch-P.chrysogenum, Tv-Trichoderma viride, Th- T.harzianum

Fig.1 Percentage growth inhibition of pathogen in the zone interaction



Aa-*Aspergillus awamori*, Af-*A.flavus*, An- *A.niger*, Ao- *A.oryzae*, As-*A.sulphures*, Asy-*A.sydowi*, Ps-*Penicillium* sp, Pc-*P.citrinum*, Pch-*P.chrysogenum*, Tv-*Trichoderma viride*, Th- *T.harzianum*

Most manufactures of *Trichoderma* strains for biological control have extensive lists of susceptibilities or resistance to a range of pesticides (Pal and Gardenar, 2006). *Trichoderma* sp. and *Gliocladium virens* which was recently named as *Trichoderma virens* are well known antagonistic fungi useful in controlling soil borne diseases. They have been used against disease caused by *B.oryzae*. (Howell and Stipanovic *et al.*, 1983). Mutants of *Trichoderma virens* that do not produce gliotoxin are reduced in their ability to control *Pythium* damping off. Amongst these fungi *Trichoderma* sp are the most widely used for example *Trichoderma harzianum*, *T. hamatum*, *T. koeningii* and *T. viride* are known to control damping off caused by *Rhizoctonia* and *Pythium* species in the field (Papavizas, 1985).

In the present investigation suggests that the microfungal interaction studies were promoted and eco-friendly conservation of soil environment. According to the pathological aspects, the pathogen *Bipolaris oryzae* was maximum suppressive activity with *T.harzianum* and *Trichoderma viride* by *in vitro* dual culture experiments. The growth

of the inhibition of pathogen in the zone of interaction was 67.0, 71.0, 65.0, 70.0, 65.0, 62.0, 67.0, 69.0, 69.0, 71.0, 79.0 and 76.0 mm with *Aspergillus, awamori, A.flavus, A.niger, A.oryzae, A.sulphureus, A.sydowi, A.terreus, Penicillium* sp, *P.citrinum, P.chrysogenum, Trichoderma viride* and *T.harzianum* recorded respectively (Table 1 and Fig. 1). It is clear from the previous results that competition plays an important role in the *T. harzianum* and *B. oryzae* interaction (Abdel-Fataah *et al.*, 2007; Franca *et al.*, 2015 and Harish *et al.*, 2007). *Trichoderma* isolates inhibited the growth of the target organisms through its ability to grow much faster than the pathogenic fungi thus competing efficiently for space and nutrients. Khalili *et al.*, (2012) reported that the *invitro* antagonism tests revealed that the native isolates of *Trichoderma* sp. significantly inhibited the mycelial growth of *B. oryzae* in several ways. The most effective isolates were belonged to *T. harzianum*.

In the current study the *Trichoderma viride* (79.0 mm) was maximum inhibition of the pathogen *Bipolaris oryzae* and followed by *T.harzianum* (76.0 mm) and minimum

percentage of inhibition of the pathogen was 62.2 mm zone of measured respectively. However the studies in fungi could be applied as suitable tools in biocontrol of fungi efficient with the ability to reduce the pathogen in the soil environment. Karthikeyan, (2016) studied that the antagonistic activity of *Trichoderma harzianum* tested against plant pathogens by in vitro dual culture experiment. Maximum percentage inhibition of *T. harzianum* *Bipolaris oryzae* (86.84%) following *A. fumigatus* (73.68%), *Humicola* sp (73.6%), *A. luchuensis* (60.5%) and *A. niger* (50%) respectively.

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