

## **Biocontrol Measures of Pineapple Disease in Sugarcane**

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### **ABSTRACT**

*The antagonistic potentiality of some soil fungi against *Ceratocystis paradoxa* (C.Moreau) a pathogen causing Pineapple disease in sugarcane was studied by dual culture method. The pathogen *Ceratocystis paradoxa* and some individual species of the soil fungi viz *Aspergillus awamori*, *A. niger*, *Gliocladium virens*, *Penicillium citrinum*, *Trichothecium sp*, *Trichoderma glaucum*, *T. harzianum*, *T. hirsuta*, *T. koeningii* and *T. viride* were grown on PDA medium individually. Three replicates for each set were maintained. The colony interactions between the pathogen and the soil fungi were assessed the following model proposed by porter (1924) and Diekinson and Broadman (1971). The results were observed and recorded.*

**Key Words:** Antagonism, *Ceratocystis paradoxa*, Pineapple disease, Soil fungi.

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### **INTRODUCTION**

Biocontrol of plant pathogen involves the use of biological processes to reduce the inoculum density of pathogen and to maintain their 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. The survival structure of the pathogen in the soil are suppressed either due to natural suppressiveness of the soil or manipulation of the soil environment. The pathogen suppression in the soil is considered as an important step in the control of disease as it involves the direct disinfestations of the soil.

Cell free culture filtrates have been used to demonstrate the role of antibiosis in biological control (Khara and Hadwan, 1990; Tu, 1992; Naik and; Sen, 1992). In the present study, antagonistic activity of some soil fungi against *C. paradoxa* has been investigated in vitro dual culture and with cell free culture filtrates of fungi amended in medium.

The saprophytic growth and activity of the pathogen varies depending upon the environmental

and soil condition. The differences in the saprophytic activities of variations in the cellulolysis rate of the organisms as suggested by Garrett, (1956). Though Garrett is pioneer in the studies on various aspects of saprophytic ability of the pathogen in soil, the conditions that inhibit the saprophytism of the pathogen may be exploited for biological control in several ways. The toxic metabolite produced by the initial fungal colonies of natural substrate may act to slow or present invasion by other species (Ambikapathy *et al.*, 1994). *Trichoderma* sp. are most common fungal biological control agents that have been comprehensively researched and deployed throughout the world.

## MATERIALS AND METHODS

### *Dual culture experiments (Skidmore and Dickinson, 1976)*

The sterilized potato dextrose agar medium was poured in to the petriplates and allowed to solidify. After solidification, colony interaction between the test pathogen *C.paradoxa* and the soil fungi were studied in vitro dual culture expermint. The test pathogen *C.paradoxa* and the soil fungi such as *Aspergillus awamori*, *A.niger*, *Gliocladium virens*, *Penicillium citrinum*, *Trichoderma glaucum*, *T.harzianum*, *T.hirsuta*, *T. viride* and *Trichothecium*, the fungal and plant pathogen were grown separately on PDA medium.

Then agar blocks cut from the actively growing margin of the individual species of plant fungi and test organism were inoculated just opposite to each other approximately 3cm apart on potato dextrose agar medium in petriplates. Three replicates for each set were maintained. Controls were set in single and dual inoculated culture of the fungus. The position of the colony margin disc was measured for every day.

Assessments were made when the fungi has achieved an equilibrium after which there was no further alteration in the growth. Since both of the organisms were mutually inhibited, the assessment was made for both organisms.

The percentage inhibition of growth was calculated as follows.

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

$r$  = growth of the fungus was measured from the centre of the colony towards the centre of the plate in the absence of antagonistic fungus.

$r^1$  = growth of the fungus was measured from the centre of the colony towards the antagonistic fungus.

The colony interaction between the test pathogen and the soil fungi were assessed following the model proposed by Porter (1924) and Dickison and Broadman (1971). Five type of interaction grade as proposed by Skidmore and Dickinson (1976) have been followed.

*They are as follows*

1. Mutual intermingling growth without any macroscopic sights of interaction – Grade - 1.
2. Mutual intermingling growth where the growth of the fungus is ceased, and being over grown by the opposed fungus - Grade - 2
3. Intermingling growth where the fungus under observation is growing into the opposed fungus either above (or) below - Grade - 3.
4. Sight inhibition of both the interacting fungi with narrow demarcation line (1-2mm) - Grade - 4

## 5. Mutual inhibition of growth at a distance of - 2mm - Grade - 5

## RESULTS AND DISCUSSION

**Antibiotic interaction between soil Fungi and *Ceratocystis paradoxa***

The types of interaction of the pathogen with soil fungi were as follows.

<i>T. koeningii</i>	- Grade - 1
<i>Gliocladium virens</i> , <i>T. viride</i> and <i>T. hirsuta</i>	- Grade - 2
<i>A. awamori</i> and <i>A. niger</i>	- Grade - 3
<i>T. harzianum</i> , <i>T. glaucum</i> and <i>Trichothecium</i>	- Grade - 4
<i>P. citrinum</i>	- Grade - 5

The maximum percentage inhibition of *C. paradoxa* with *T. koeningii* (75) followed by *Gliocladium virens* (73.8), *T. viride* (73.8), *T. hirsuta* (72.3), *A. awamori* (70), *A. niger* (69.2), *T. harzianum* (56.9), *T. glaucum* (53.8), *Trichothecium* (53.8) and *P. citrinum* (23.1) (Table 1), It is evident that the antibiotic production varies depending on the competing organisms.

The mycelium of *T. koeningii*, *Gliocladium virens* and *T. viride* were found growing over the pathogen. The antagonistic properties of different species of *Aspergillus*, *penicillium*, *Trichothecium* and *Trichoderma* against different pathogens have also been reported (panneerselvam and sarsvanamuthu, 1994, 1996, 1999, Ambikapathy *et al.*, 2000 ; Madhanraj *et al*, 2009; Muthukumar *et al.*, 2006, Gomathi and Ambikapathy, 2011) Table – 1

Prince and Prabakaran (2011) studied that the antifungal activity of eight different medicinal plants namely *Aloe vera*, *Ocimum sanctum*, *Cenetella asiatica*, *Piper betle*, *Calotropis gigantea*, *Vitex negundo*, *Ocimum basilicum* and *Azadirachta indica* were tested against plant pathogenic fungus (red rot disease causing agent) *Colletotrichum falcatum*. Among the different plant tested, all the three solvents of the *Vitex negundo* showed maximum antifungal activity against the plant pathogen tested.

**Table–1. Colony interactions between *C. paradoxa* and some soil fungi in dual culture experiments**

S. No.	Growth response of the antagonistic and Test Fungus	Antagonistic Fungi Tested									
		Aa	An	Gli	Pc	Tg	Th	Thi	Tk	Tv	Tri
1	Colony growth of the pathogen towards antagonist (mm)	19.0	20.0	17.0	50.0	30.0	20.0	18.0	16.0	17.0	30.0
2	Colony growth of the pathogen away from the antagonist (mm)	21.0	24.5	18.5	55.0	37.0	24.0	22.0	19.0	21.0	35.0
3	% growth inhibition of the pathogen in the zone of interaction.	70.0	69.2	73.8	23.1	53.8	56.9	72.3	75.0	73.8	53.8
4	Colony growth of the antagonist in control ie growth towards the center of the plate in the absence of the pathogen (mm)	73.0	71.0	76.0	65.0	65.0	62.0	73.0	73.0	71.0	69.0
5	Colony growth of the antagonist towards the pathogen (mm)	67.0	63.0	69.0	27.0	51.0	50.0	65.0	63.0	61.0	52.0
6	Colony growth of the antagonist away from the pathogen (mm)	58.0	56.0	56.0	19.0	45.0	41.0	51.0	55.0	49.0	43.0
7	% growth inhibition in the zone of interaction	8.0	11.2	9.2	58.4	21.5	11.2	10.9	13.6	14.0	24.6

Aa-*A. awamori*, An-*A. niger*, Gli-*Gliocladium virens*, Pc-*Penicillium citrinum*, Tg-*Trichoderma glaucum*, Th-*T. harzianum*, Thi-*T. hirsuta*, Tk-*T. koeningii*, Tv-*T. viride* and *Trichothecium*.

Growth of *C. paradoxa* towards the centre of the plate in the absence of any antagonistic fungus (control) was 65mm. measurement was taken in to after 72 hours.

The staling products of the antagonistic fungi inhibited the growth of *C. paradoxa* 20% concentration. Antibiotic substances as staling growth products in liquid cultures has already been emphasized (Robinson, 1969 ; Fravel, 1988).

Differential sensitivity of the pathogen to the staling growth products of the fungi was also

observed. This may be due to the genetic potentialities of the pathogen to tolerate a particular antibiotic substance and the chemical properties of the staling substances. It has also been reported that the environmental parameters, nutrients, also influences the antifungal activity of a pathogen.(Fravel, 1988).

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