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Management of *Colletotrichum gloeosporioides* (Penz.) causing cashew anthracnose through bio-control agents

RR Satapathy and SK Beura

Abstract
Cashew (*Anacardium occidentale* L.) is popularly known as the 'Gold mine' of wasteland. Initially, it was considered as a suitable crop for soil conservation, afforestation and also wasteland development but gradually gained commercial importance. In cashew cultivation, production and processing, Odisha stands third in India, claiming 16% of land under cashew cultivation area at 1.68 Lakh hectares and producing 1,00,000 MT of raw cashew nut (13.6% of India's raw cashew nut production). Cashew is infected by more than 20 diseases worldwide. Among the diseases, anthracnose caused by *Colletotrichum gloeosporioides* (Penz.), perfect stage *Glomerella cingulata* (Ston.) Spauld. & Schrenk is a serious menace in cultivation of cashew causing economic loss in Odisha. The present investigation was carried out with an objective to study the efficacy of some bio-control agents in *in-vitro* condition. Four antagonistic microorganisms like *Trichoderma viride, Trichoderma harzianum, Trichoderma hamatum* and *Pseudomonas fluorescens* were maintained in medium of potato dextrose agar and evaluated for their antagonistic effect under *in-vitro* condition against *Colletotrichum gloeosporioides* by dual culture technique. It has been found that the maximum growth inhibition was seen in case of *Trichoderma viride* (84.9%) followed by *T. harzianum* (77.4%). However, least inhibition of 74.5% was recorded in *T. hamatum.* However the testing of bio-control agents may be carried out under field condition for further confirmation.

Keywords: Cashew, bio-control, *Trichoderma*

Introduction
Cashew (*Anacardium occidentale* L.) is popularly known as the 'Gold mine'of wasteland. Cashew was originally introduced into India from Brazil in the sixteenth century mainly for checking soil erosion on the coast. Initially, it was considered as a suitable crop for soil conservation, afforestation and also wasteland development but gradually gained commercial importance.

Odisha stands third in Cashew cultivation, production and processing in India, claiming 16% of land under cashew cultivation area at 1.68 Lakh hectares and producing 1,00,000 MT of raw cashew nut (13.6% of India's raw cashew nut production). The major cashew growing districts in Odisha are Dhenkanal, Koraput, Cuttack, Puri, Ganjam, Sambalpur, Balasore and Sundargarh. As on date, there are more than 350 cashew processing industries processing approximately 125000 MT of raw cashew nuts, thus generating 35,000 employment opportunities every day. Raw cashew nut sector generates annual revenue of Rs 950 crores converting raw cashews into kernels by processing earn an additional value of more than Rs 250 crores. Hence Odisha cashew sector generates approximately Rs 1200 crores every year.

Various factors are responsible for low yield of the crop especially diseases play a vital role. There are more than 12 diseases which are reported to infect cashew tree worldwide. Anthracnose foliar blight, fruit rot, gummosis of twigs and trunk are often considered as the most relevant diseases causing severe damages across cashew growing areas. Among the diseases anthracnose caused by (*Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc.), perfect stage (*Glomerella cingulata* (Ston.) Spauld. & Schrenk) is a common pathogen of cashew causing huge loss in yield.

Chemicals that are used in plant disease management have much adverse environmental effect. At present many antagonistic micro-organisms are evolving which can be used for the management of plant diseases. Keeping in view of these facts, the investigation on "Evaluation on fungi toxic effect of some bio-control agents against plant pathogens" was undertaken.

Materials and Methods

The antagonistic microorganisms like *Trichoderma viride*, *Trichoderma harzianum*, *Trichoderma hamatum* and *Pseudomonas fluorescens* were maintained in medium potato dextrose agar and evaluated for their antagonistic effect under *invitro* condition against *Colletotrichum gloeosporioides* by dual culture technique.

Dual culture technique

In dual culture technique, twenty ml of sterilized and cooled potato dextrose agar was poured into sterile petri dishes and allowed to solidify. The pathogen was inoculated at one side of petri dish and the antagonist inoculated exactly at opposite side of the same plate by leaving 3-4 cm gap. For this, actively growing cultures were used. Each treatment was replicated 5 times. After required period of incubation i.e. after control plate reached growth of 90 mm diameter, the radial growth of pathogen was measured. Per cent inhibition over control was worked out according to formulae given by Vincent (1947) as follows.

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

I = Per cent inhibition of mycelium

C = Growth of mycelium in control

T = Growth of mycelium in treatment

Result

The effect of four antagonists such as *Trichoderma viride*, *T. harzianum*, *T. hamatum and Pseudomonas fluorescens* were studied against the test fungus (*Colletotrichum gloeosporioides*) as per the procedure described under the "Materials and Methods" which is presented in the table 1 and figure 1.

Table 1: In vitro study of antagonists on the growth of test fungus

Sl. No	Antagonists	Growth Inhibition (%)
1	*Trichoderma viride*	84.9
2	*Trichoderma harzianum*	77.4
3	*Trichoderma hamatum*	74.5
4	*Pseudomonas fluorescens*	75.5
	SE(m)	± 0.59
	CD (0.05)	1.785

It is revealed from the table 1 that, the maximum growth inhibition was seen in case of *Trichoderma viride* (84.9%) followed by *T. harzianum* (77.4%). However, least inhibition of 74.5% was recorded in *T. hamatum.*

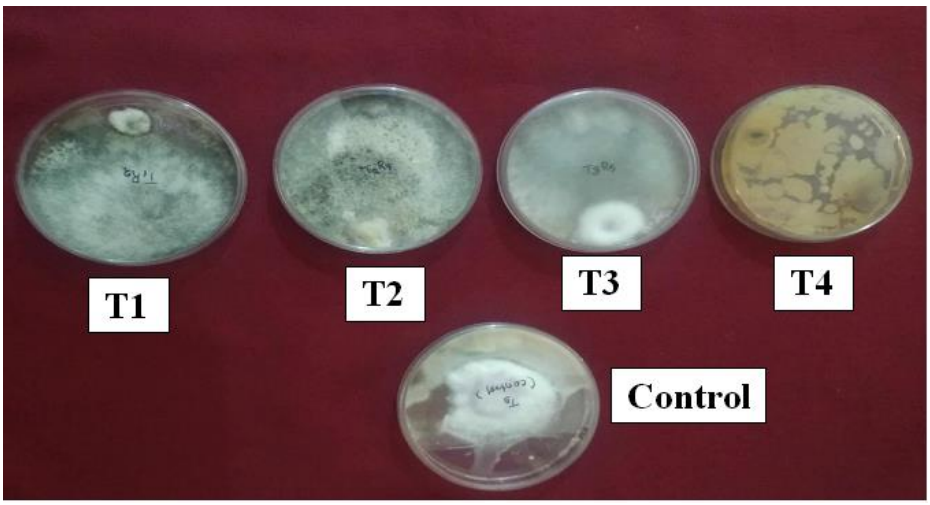

Fig 1: Effect of different antagonists on the test pathogen, T1- *Trichoderma viride*, T2- T. harzianum, T3 - *T.hamatum*, T4 - *Pseudomonas fluorescens*

Discussion

Among the bio-control agents evaluated against the test pathogen, highest per cent of growth inhibition was observed in case of *Trichoderma viride* (84.9%), followed by *T. harzianum* (77.4%). The *Trichoderma sp* as an efficient bio control agent was reported earlier by different workers. Patil (2009) [3] reported that among the bio agents, *Trichoderma viride* was found effective with 70.42 per cent growth inhibition of *Colletotrichum gloeosporioides.* Patil and Joshi (2010) [4] reported that the antagonistic effect of bio agents on *C. gloeosporioides in vitro* revealed that *Trichodenna harzianum* and *T. viride* were most effective. Ghosh (2012) [1] reported that *Trichoderma viride* inhibited the maximum mycelial growth of the *Colletotrichum gloeosporioides.* Kothikar (2017) [2] reported *Trichoderma viride* inhibited maximum mycelial growth i.e. 80.11% while *T. harzianum* inhibited minimum mycelial growth i.e. 71.51%.

Conclusion

The comparative fungi toxic potential of four bio-control agents was assessed against Colletotrichum gloeosporioides. It revealed that maximum per cent growth inhibition was observed in case of Trichoderma viride (84.9%) followed by T. harzianum (77.4%).

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