Efficacy of Fungicides and Bioagents Against *Colletotrichum gloeosporioides* Causing Blight In *Piper longum*

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SUMMARY

Among chemicals, mancozeb + carbendazim (0.2%) was found most effective in inhibiting 96.26 per cent growth of *Colletotrichum gloeosporioides* followed by carbendazim (0.1%) 68.34 per cent, mancozeb (0.25%) 67.51 per cent and copper oxychloride (0.3%) 64.88 per cent. Among the bioagents, *Trichoderma viride* was found effective with 70.42 per cent growth inhibition. In field experiment, spraying of mancozeb + carbendazim (0.2%) was found effective with 33.38 per cent disease control followed by carbendazim (0.1%), copper oxychloride (0.3%) and *Trichoderma viride* (6 x 10^7 CFU/ml) 30.95, 30.10 and 28.46 per cent disease control.

Key words : Fungicides, Bioagents, *Colletotrichum gloeosporioides, Piper longum.*

Long pepper or Pimpri is the unripe spike of *Piper longum* L. which is native of Indo-Malaya region. In India, it is grown on small scattered pockets mainly in Assam, Khasi hills, lower hills of West Bengal, Eastern Ghats in Kerala, Karnataka and Tamil Nadu (Anonymous, 1969). It has also been reported from Andhra Pradesh and Andaman and Nicobar Island. In Akola-Amravati region, farmers are cultivating a particular race of *Piper longum* L. In India, Pimpri is widely used in Ayurvedic and Unani systems of medicine. The whole spike which consists of minute fruits embedded in a fleshy rachis is used as medicine. It is picked before fully ripe and then dried. The green spike to dry spike ratio is 10:1.5. Besides fruits, the roots and thicker parts of stem are cut and dried and used as an important drug 'Piplamul' which contains Piperine, Piplartine, Triacotone, Dihydromasterol etc. (Anonymous, 1969).

MATERIALS AND METHODS

Efficacy of fungicides by poisoned food technique:

Poisoned food technique was used to evaluate the above mentioned fungicides *in vitro* against *Colletotrichum gloeosporioides.* The inoculated plants were incubated at room temperature for five days.

The colony diameter of the fungal pathogen on medium was recorded and per cent inhibition in each treatment was calculated (Vincent, 1927) by using the following formula.

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

where,

I = Growth inhibition percentage

C = Growth of the fungus in control plates

In vitro the efficacy of following fungicides and bioagents against *Colletotrichum gloeosporioides* were tasted

Sr. No.	Chemical name	Trade name	Concentration (%)
Chemicals			
1.	Mancozeb	Indofil M-45	0.25
2.	Tridemorph	Calixin	0.10
3.	Copper oxychloride	Blitox	0.30
4.	Carbendazim	Bavistin	0.10
5.	Mancozeb +Carbendazim	Companion	0.20
6.	Control		
Bioagents			
1.	*Trichoderma viride*	-	-
2.	*Trichoderma harzianum*	-	-
3.	*Pseudomonas fluorescens*	-	-
4.	Control	-	-

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T = Growth of the fungus in treated plates

Efficacy of bioagents by dual culture technique:

The six mm diameter discs of *Trichoderma viride* and *T. harzianum* were cut from peripheral growth of the plate using sterilized cork borer under aseptic condition and put three discs at equidistance from centre on the Petri plate of solidified medium and disc of pathogen separately were kept at the centre. Control plates, containing only pathogen were also maintained. The treatments were replicated thrice. The radial mycelial growth of pathogen was measured on fifth day and inhibition per cent was calculated.

Antagonistic properties of *Pseudomonas fluorescens* was tested against fungal pathogen on PDA using a dual culture technique. A loopful of 24 hours old culture of bacterial strain was inoculated at 2 cm just opposite to the pathogen on each plate. The plates were incubated at 27 ± 2^0C for 5 days and per cent growth inhibition was calculated.

Management of* disease *blight in vivo:

A field trial was carried out in randomized block design with a local race of *Piper longum* Linn. (Pimpri) with nine treatments in three replications at Betelvine Research Station, Diwthana, during August to December 2007.

Treatment details		
Tr. No.	Treatment	Concentration (%)
T_1	Mancozeb	0.25
T_2	Tridemorph	0.1
T_3	Copper oxychloride	0.3
T_4	Carbendazim	0.1
T_5	Mancozeb + Carbendazim	0.2
T_6	*Trichoderma viride*	10^7 CFU/ml
T_7	*Trichoderma harzianum*	10^7 CFU/ml
T_8	*Pseudomonas fluorescens*	10^9 CFU/ml
T_9	Control	

Preparation of spray formulation and application:

The artificial inoculation with conidial suspension of *Colletotrichum gloeosporioides* was done with the help of spraying method. The formulation of chemicals and bioagents to be used for management of disease were made separately by adding specified amount of chemicals and bioagents in water and control plot was sprayed with water.

Method of observation:

For measurement of disease intensity, the efficacy of chemicals and bioagents was done as per score card. Five plants were selected randomly from a plot and six leaves of each plant (2 bottom, 2 middle and 2 top) were observed for measurement of disease intensity on the basis of relative percentage of leaf area covered by the disease. Six observations were recorded first before spray and second to six at ten days after spraying. Second to sixth observations were considered for calculating the PDI and calculated by using the following formula:

$$\text{PDI} = \frac{\text{Sum of all numerical ratings}}{\text{No. of leaves examined per vine x Maximum rating}} \text{ x } 100$$

$$\text{PDC} = \frac{\text{PDI in control - PDI in treatment}}{\text{PDI in control}} \times 100$$

RESULTS AND DISCUSSION

Efficacy of different chemicals against Colletotrichum gloeosporioides by poisoned food technique:

Data presented in Table 1 revealed that the combination of mancozeb + carbendazim (0.2%) was significantly superior over all the treatments with 96.26 per cent inhibition of the fungus followed by carbendazim (0.1%) 68.34 per cent, mancozeb (0.25%) 67.51 per cent and copper oxychloride (0.3%) 64.88 per cent inhibition. The lowest inhibition (63.62 per cent) was observed in treatment of tridemorph (0.1%).

Table 1: Efficacy of different chemicals against *Colletotrichum gloeosporioides* by poisoned food technique

Tr. No.	Treatments	Conc.	Radial mycelial growth (mm)	Per cent growth inhibition
T_1	Mancozeb	0.25	14.44	67.51
T_2	Tridemorph	0.1	16.17	63.62
T_3	Copper oxychloride	0.3	15.61	64.88
T_4	Carbendazim	0.1	14.07	68.34
T_5	Mancozeb+carbendazim	0.2	1.66	96.26
T_6	Control		44.45	
	'F' test		Sig.	
	S.E.±		0.52	
	C.D. (P=0.01)		2.26	

Prashanth and Sataraddi (2007) and Venkataravanappa *et al*. (2006) observed carbendazim + mancozeb as superior in inhibiting the mycelial growth of *Colletotrichum gloeosporioides*, Haralpatil (2006) has also reported the efficacy of copper oxycloride against *Colletotrichum gloeosporioides*. These findings confirm the present results.

Efficacy of different bioagents against *Colletotrichum gloeosporioides* by dual culture technique *in vitro:*

Data presented in Table 2 revealed that the bioagent,

Table 2: Efficacy of different bioagents against *Colletotrichum gloeosporioides* by dual culture technique *in vitro*

Tr. No.	Treatments	Radial mycelial growth (mm)	Per cent growth inhibition
T_1	*Trichoderma viride*	13.10	70.42
T_2	*Trichoderma harzianum*	14.66	66.90
T_3	*Pseudomonas fluorescens*	35.12	20.72
T_4	Control	44.30	-
	'F' test	Sig.	
	S.E. ±	1.054	
	C.D. (P=0.01)	4.551	

Trichoderma viride significantly reduced the mycelial growth (70.42%) of *Colletotrichum gloeosporioides* followed by *Trichoderma harzianum* (66.90%) and the least inhibition (20.72%) was found in *Pseudomonas fluorescens*. Jayalakshmi *et al*. (1998) and Patel and Joshi (2001) reported the maximum inhibition of *Colletotrichum gloeosporioides* by *Trichoderma viride*. The observations is in concurrence with the results of the present investigation. Bhave and Raut (2005) also proved *Trichoderma viride* and *T. harzianum* as antagonistic against *Colletotrichum gloeosporioides* which also confirms the present results.

All the treatments were found significantly superior over control in reducing the disease intensity. Minimum disease intensity was observed in foliar spray of mancozeb + carbendazim (0.2%) and it was found at par with foliar sprays of carbendazim (0.1%) alone followed copper oxychloride (0.3%), and *Trichoderma viride* and mancozeb. Maximum disease intensity was recorded in control. Highest disease reduction (33.38) was recorded in spraying of mancozeb + carbendazim (0.2%) followed carbendazim (0.1%) alone (30.95). Among bioagents, *Tricoderma viride* recorded 28.46 per cent disease control. Gaikwad (2000) and Gaikwad *et al.* (2002) reported that carbendazim + mancozeb (0.2%) was effective against *Colletotrichum gloeosporioides*. Mittal (1993) stated the effectivity of seed treatment with carbendazim plus foliar spray of mancozeb against anthracnose of black gram. Maiti and Sen (1978) reported that benzimidazole fungicides, bavistin (0.1%) and benlate (0.1%) were highly effective in controlling Colletotrichum leaf spot of betelvine. Saikia and Addy (1987) and Ebenezer and Subramanian (1996) also reported similar findings which confirm the present results.

Table 3: Efficacy of different chemicals and bioagents on blight of *Piper longum in vivo*

Treatments	Con. (%)	Per cent disease intensity					% Disease control
		August	September	October	November	December	
Mancozeb	0.25	22.50 (4.74)	22.68 (4.76)	21.28 (4.58)	20.68 (4.45)	18.88 (4.34)	24.47
Tridemorph	0.1	23.51 (4.84)	25.72 (5.07)	23.32 (4.81)	20.86 (4.56)	19.42 (4.40)	19.62
Copper oxychloride	0.3	20.27 (4.50)	25.72 (5.07)	19.31 (4.39)	18.88 (4.33)	17.63 (4.19)	30.10
Carbendazim	0.1	20.16 (4.48)	22.04 (4.69)	19.18 (4.37)	18.75 (4.32)	17.52 (4.18)	30.95
Mancozeb + Carbendazim	0.2	19.40 (4.40)	21.32 (4.61)	18.70 (4.31)	17.64 (4.19)	16.78 (4.09)	33.38
Trichoderma viride	10^7 CFU/ml	20.39 (4.51)	22.51 (4.74)	19.52 (4.41)	20.12 (4.47)	17.89 (4.22)	28.46
Trichoderma harzianum	10^7 CFU/ml	24.19 (4.91)	26.12 (5.11)	24.56 (4.95)	21. 11(4.64)	19.25 (4.38)	17.91
Pseudomonas fluorescens	10^9 CFU/ml	25.34 (5.03)	27.18 (5.21)	25.12 (5.00)	22. 32 (4.72)	21.35 (4.62)	13.57
Control		28.78 (5.36)	29.46 (5.42)	28.72 (5.34)	28.01 (5.28)	25.42 (5.04)	
Sig.		Sig.	Sig.	Sig.	Sig.	Sig.	
S.E. ±		0.124	0.14	0.12	0.11	0.07	
C.D. (P=0.05)		0.37	0.43	0.36	0.33	0.21	

Values in parenthesis are arcsine

Efficacy of different chemicals and bioagents on blight of Piper longum in vivo:

The data presented in Table 3 revealed that the disease intensity was found slightly increased after first spraying *i.e.* in September after second spraying a declined trend in all the treatments was observed after every spraying.

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