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Evaluation of fungicides against leaf spot of turmeric caused by *Colletotrichum capcisi*

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ABSTRACT

Fungicides are the common tool for the management of leaf spot of turmeric crop caused by *Colletotrichum capsici* (syd.) Buttler and Bisby. The efficacy of six (6) fungicides *viz*., blitox-50, carbendazim, carbendazim 12 per cent + mancozeb 63 per cent, captan, mancozeb and matalaxyl were evaluated at minimum dose against the pathogen. Amongst the fungicides, carbendazim 12 per cent + mancozeb 63 per cent @ 0.2 per cent was found significantly effective in inhibiting the mycelial growth (4.47 cm) of the pathogen. Effect of carbendazim in inhibiting the mycelial growth of *C. capsici* was found next (2.90 cm) to carbendazim 12 per cent + mancozeb 63 per cent. Mancozeb (1.80 cm) and captan (1.62 cm) also showed effective results as compared to matalaxyl (1.0 cm).

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INTRODUCTION

Turmeric (*Curcuma longa* L.) is one of the most important spice crops cultivated in Assam, India. Turmeric is highly prone to several fungal diseases out of which leaf spot caused by *Colletotrichum capsici* (syd.) Butler and Bisby is important (Chidanandaswamy, 2001). The disease in turmeric causes an economic loss of 25.83 to 62.12 per cent fresh weight and 42.10 to 62.10 per cent dry weight of mother and finger rhizomes, respectively (Hudge *et al*., 2010). The pathogen also causes anthracnose to a wide range of hosts *viz.*, cereals, legumes, vegetables, perennial crops, and tree fruits. For the management of fungal diseases, fungicides are most common tools. But, in recent years, there has been growing concern over their use due the potential hazardous effect on soil microflora and residual effect in the soil. This fact led to search for minimum dose of fungicides that can use for the management of the diseases, more particularly within the frame work of integrated diseases management (IDM) approach. IDM approach allows minimum use of chemicals that can hold the disease below the economic threshold level. In the present study the efficacy of 6 chemicals has been tested at minimum dose against the pathogen causing leaf spot of turmeric.

MATERIAL AND METHODS

The experiment was conducted in the Mycology Research Section, Department of Plant Pathology, Assam Agricultural University, Jorhat, Assam, India during 2012-2013.

Isolation and maintenance of pathogen :

Infected leaves of turmeric showing typical symptoms of leaf spot were collected from Instruction-cum-Research (ICR) farm, Assam Agricultural University, Jorhat. The fungus

causing leaf spot of turmeric was isolated by hyphal tip culture method on Potato dextrose agar (PDA) medium. The pathogen was identified based on its mycelial and conidial characteristics following the standard mycological keys (Barnett and Hunter, 1972) and was maintained separately on PDA medium for further studies.

Pathogenicity of *Colletotrichum capsici* isolate :

Pathogenicity test of the isolated fungus was tested by spray inoculation method. Turmeric plants at active vegetative stage were chosen and wounds were made by pin prick method. Spore suspension (1×10^4 conidia ml^{-1} of water) was sprayed on the wounded area with atomizer. After inoculation seedlings were covered with polythene bags for 48 hrs. to ensure high humidity by spraying sterile distilled water to create congenial environmental condition for conidial germination and infection. Within 7-10 days on inoculation, typical symptom development was recorded and the pathogen was reisolated to prove the Koch's postulate.

Evaluation of fungicides against *C. capsici* isolate :

The relative efficacy of six recommended fungicides at 0.2 per cent was tested against the isolated pathogen under *in vitro* condition by following paper disc method (Ericson, 1960; Dobre *et al.*, 2011 and Aftab *et al*., 2012).

Paper disc method :

For paper disc method scraped the mycelial growth of *C. capsici* from 7 day old culture plate and mixed with cooled PDA medium under aseptic condition. Then a sterile filter discs (Whatman filter paper no. 1, 6 mm diameter) were impregnated with fungicide solutions and placed on the agar surface using sterilized forceps. These plates were incubated at 28 ± 1°C for 3 days. Plates with filter paper discs without any fungicide served as control. Growth inhibition was assessed by the presence of inhibition zone around the filter paper disc. Diameter of inhibition zone was measured and compared with control.

RESULTS AND DISCUSSION

Among the six fungicides tested in paper disc method (Table 1 and Plate 1), Carbendazim 12 per cent + Mancozeb 63 per cent @ 0.2 per cent was found significantly effective in inhibiting the mycelial growth (4.47 cm) of the pathogen. Carbendazim 12 per cent + Mancozeb 63 per cent have two way mode of action. Mancozeb acts by contact action which inactivates the sulphahydral group of enzymes in *C. capsici*, causing disturbance in fungal enzyme functioning. while, carbendazim having systemic activity acts by inhibiting fungal mitotic microtubule formation resulting in inhibiting the fungal germ tube development and mycelial growth of *C. capsici* (Singh, 2008 and Vidhyasekaran, 1993). Effect of carbendazim with an inhibition zone of 2.9 cm was found next to carbendazim 12 per cent + Mancozeb 63 per cent. Carbendazim affects mitosis and cell division of the pathogen by inhibiting β-tubulin synthesis. It suppresses the spindle microtubules, disturbs the chromosomal alignment at the metaphase plate and microtubule-kinetochore interactions causing chromatid loss, chromosome loss or non-disjunction in cells of the test pathogen. It also inhibits mitochondrial fumarate reductase, reduces glucose transport, and uncouple oxidative phosphorelation. Inhibition zone recorded for mancozeb and captan was 1.80 cm and 1.62 cm, respectively. Captan (N-trichloromethylthio-4-cyclohexene-1, 2-dicarboxymide) is a non-specific thiol reactant which inhibits respiration of the test fungi. While mancozeb (manganese ethylene bisdithiocarbamate) inactivates the enzymatic activity of the pathogen. Matalaxyl was not found effective in inhibiting the growth of *C. capsici*. This may be due to the fact that it is mostly effective against lower group of fungi (like oomycetes group) but *C. capsici* belongs to ascomycetes group.

Swamy and Kulkarni (2003) also evaluated *in vitro* some fungicides against *Colletotrichum capsici*, causing leaf-spot of turmeric and Tasiwal *et al.* (2008) against *C. gloeosporioides* causing anthraenose of papaya.

The fungicides found effective *in vitro* condition can be further tested underfield trails (Singh *et al.*, 2003 and

Table 1 : *In vitro* efficacy of fungicides against *C. capsici* (Paper disc method)

Treatments	Formulations	Dose (%)	Inhibition zone (cm)*
Control		-	-
Blitox- 50 (Copper oxy chloride)	50% WP	0.2	-
Carbendazim (Methyl-2-benzimidazole carbamate)	50% WP	0.2	2.90
Carbendazim 12% + Mancozeb 63%	75% WP	0.2	4.47
Captan (N-trichloromethylthio-4-cyclohexene-1,2-dicarboxymide)	50% WP	0.2	1.62
Mancozeb (Managanese ethelene bisdithiocarbamate)	75% WP	0.2	1.80
Matalaxyl {N-(2,6-Dimethylphenyl)-N (Methoxyacetyl) Alanine Methyl ester}	68% WP	0.2	1.00
S.E. ±			0.02
C.D. (P = 0.05)			0.07

*Data are mean of three replications

Gorawar *et al.*, 2005).

Conclusion :

From the experiment it can concluded that carbendazim 12 per cent + mancozeb 63 per cent @0.2 per cent can effectively control the growth and development of *C. capsici*, the causal agent of leaf spot of turmeric. Through field experiment this result can further be tested.

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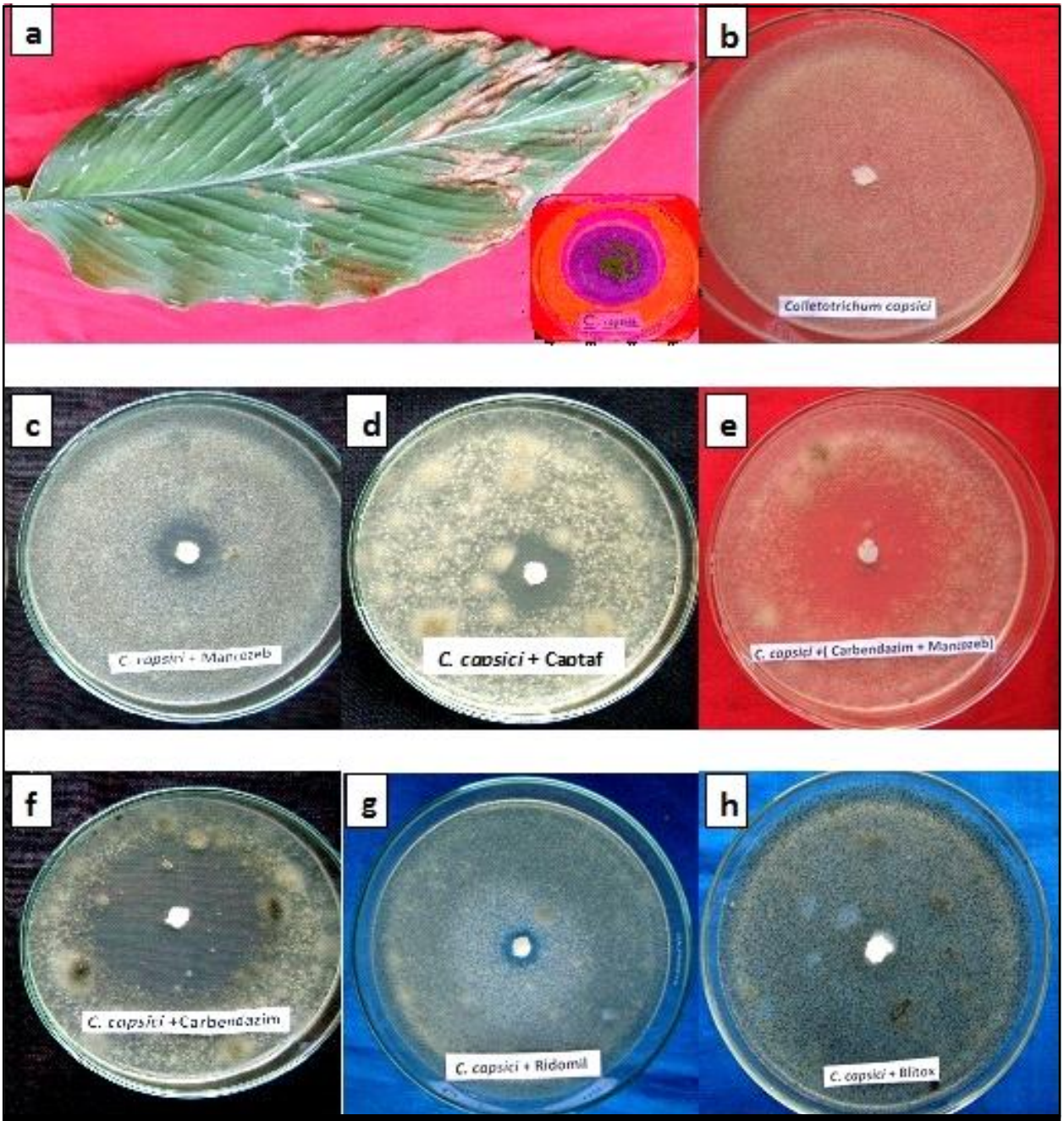

Plate. 1 : a . leaf spot of turmeric (Inset pure culture of *Colletotrichum capsici*), (b-h): Efficacy of fungicides against *Colletotrichum capcisi* b. Control (*C.capsici*), c. Mancozeb, d. Captan, e. Carbendazium 12 per cent + Mancozeb 63 per cent, f. Mancozeb, g. Matalaxyl, h. Blitox- 50

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