

Original Research Article

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***In vitro* Efficacy of Fungicides against *Alternaria brassicicola* Causing Alternaria Leaf Spot of Cabbage**

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Cabbage [*Brassica oleracea* var *capitata* (L.)] is an economically important cool season vegetable crop belongs to family Cruciferae. *Alternaria* leaf spot of cabbage caused by *Alternaria brassicicola* is the most destructive disease causing significant yield losses every year. *In vitro* evaluation were done with fungicides including the new generation viz., propiconazole, hexaconazole, tebuconazole, azoxystrobin each at three different concentrations (0.05%, 0.1%, 0.2%) and propineb, mancozeb, copper oxychloride at 0.1%, 0.2% and 0.4% concentrations respectively against the pathogen using poisoned food technique. The results revealed that propiconazole, hexaconazole, tebuconazole and copper oxychloride completely inhibited the mycelial growth of pathogen followed by mancozeb (0.1%), propineb (0.1%) and azoxystrobin (0.1%) by 51.1%, 50% and 27.7% respectively.

Introduction

Cabbage is the most popular cool season vegetable crop cultivated all over the world belongs to the family Cruciferae. The economic part of cabbage is head formed by overlapping of thick leaves around the terminal bud. The weight of head is about 0.5 - 4 kg.

Cabbage is an important source of vitamin C, Vitamin K, Vitamin B6 and folate. Apart vegetable crop it is consumed in different forms i.e., pickling, soups and sauerkraut. It has anti-inflammatory and anti-ageing properties.

The total production of cabbage was 71.8 metric tonnes in the world. China is the largest producer of cabbage with 33.4 million tonnes followed by India with nine million tonnes. The crop has been originated from mediterranean regions.

As the economic part of cabbage is head, *Alternaria* leaf spot caused by *Alternaria brassicicola* becomes an emerging and widespread disease affecting the production of crop from seedling to harvest stage. Initially dark lesions are usually seen on leaf enlarges and develop concentric zonations. These lesions will coalesce together and thereby defoliation occurs (Dillard *et al.*, 1997).

The best way to combat the disease is by utilization of high yielding resistant varieties. In absence of this resistant variety usage of fungicides was an alternate strategy to tackle the disease.

Thereby the present study were undertaken to determine the efficacy of fungicides under *in vitro*, so it can be used to manage the *Alternaria* leaf spot of cabbage.

Materials and Methods

The efficacy of four systemic fungicides i.e., propiconazole, hexaconazole, tebuconazole, azoxystrobin and three contact fungicides i.e., mancozeb, propineb and copper oxychloride were evaluated at three different concentrations against *Alternaria brassicicola* using poison food technique (Nene and Thapliyal, 1982).

For this, double strength potato dextrose agar medium is used. 50 ml of double strength PDA medium and 50 ml of distilled water was poured in separate conical flasks and sterilized in an autoclave. The fungicide was mixed in sterile distilled water and swirled well. Then fungicide suspension was poured into melted and cooled PDA medium and properly agitated to get uniform suspension.

Then 15 ml of poisoned medium was poured into sterilized petriplates under aseptic conditions and allow to solidify it. Five mm disc cuts were taken from actively growing seven days old culture plate by using cork borer and inoculated at the centre of petriplate containing poisoned medium. Inoculating the pathogen at the centre of petriplate on PDA without poisoning serve as control. Three replications were maintained for each treatment and plates were incubated at room temperature $25\pm 2^{\circ}\text{C}$. Observations on colony diameter were taken when the pathogen grown full in the control plate.

The per cent inhibition of mycelial growth of pathogen over control was calculated by using the formula (Vincent, 1947)

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

Where,

I = Per cent inhibition of the pathogen
C = Pathogen growth in control plate
T = Pathogen growth in treatment plate

Results and Discussion

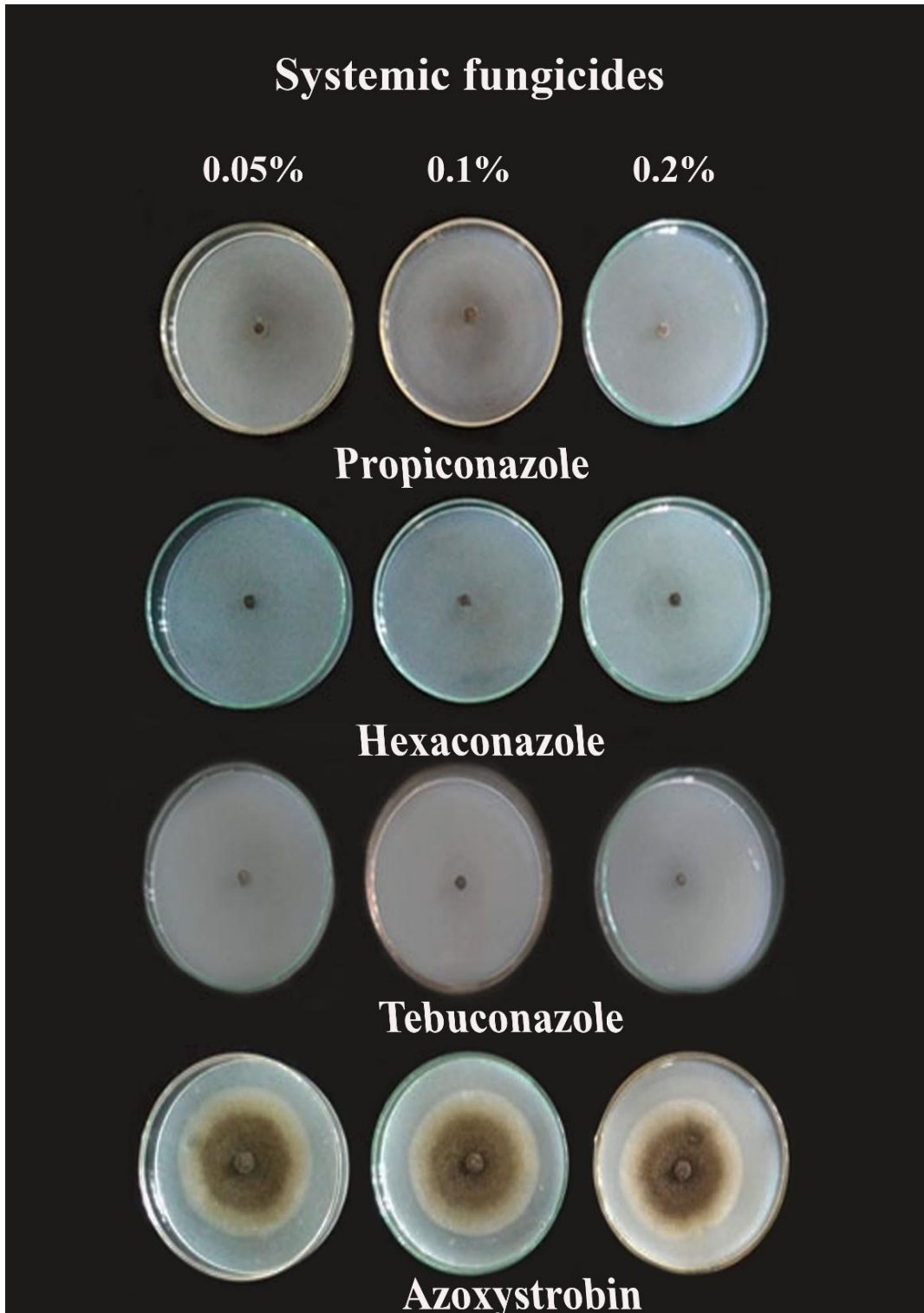
Efficacy of four systemic fungicides was evaluated at three different concentrations 0.05%, 0.1%, 0.2% against *Alternaria brassicicola*. The result revealed that all the triazoles i.e., propiconazole, tebuconazole, hexaconazole completely inhibited the growth of pathogen which were significantly on par each other and least inhibition by azoxystrobin (27.7%, 31.1%, 33.3%) at 0.05%, 0.1% and 0.2% concentrations (Table 1).

Tu and Somasekhara (2015) reported that the growth of *Alternaria brassicicola* is completely inhibited by the fungicides propiconazole and tebuconazole.

Singh and Singh (2006) reported that the fungicide hexaconazole shown 100% inhibition of the pathogen *Alternaria alternata*, the incitant of alternaria blight of tomato.

Ginoya and Gohel (2015) reported that tebuconazole and hexaconazole completely inhibited the mycelial growth of *Alternaria alternata* in chilli. Surviliene and Dambrauskiene (2006) tested the efficacy of strobilurin fungicides against *Alternaria dauci* and revealed that the percentage of inhibition was 13.33% with azoxystrobin and 14.44% with trifloxystrobin.

Plate.1 *In vitro* efficacy of fungicides against *A. brassicicola*



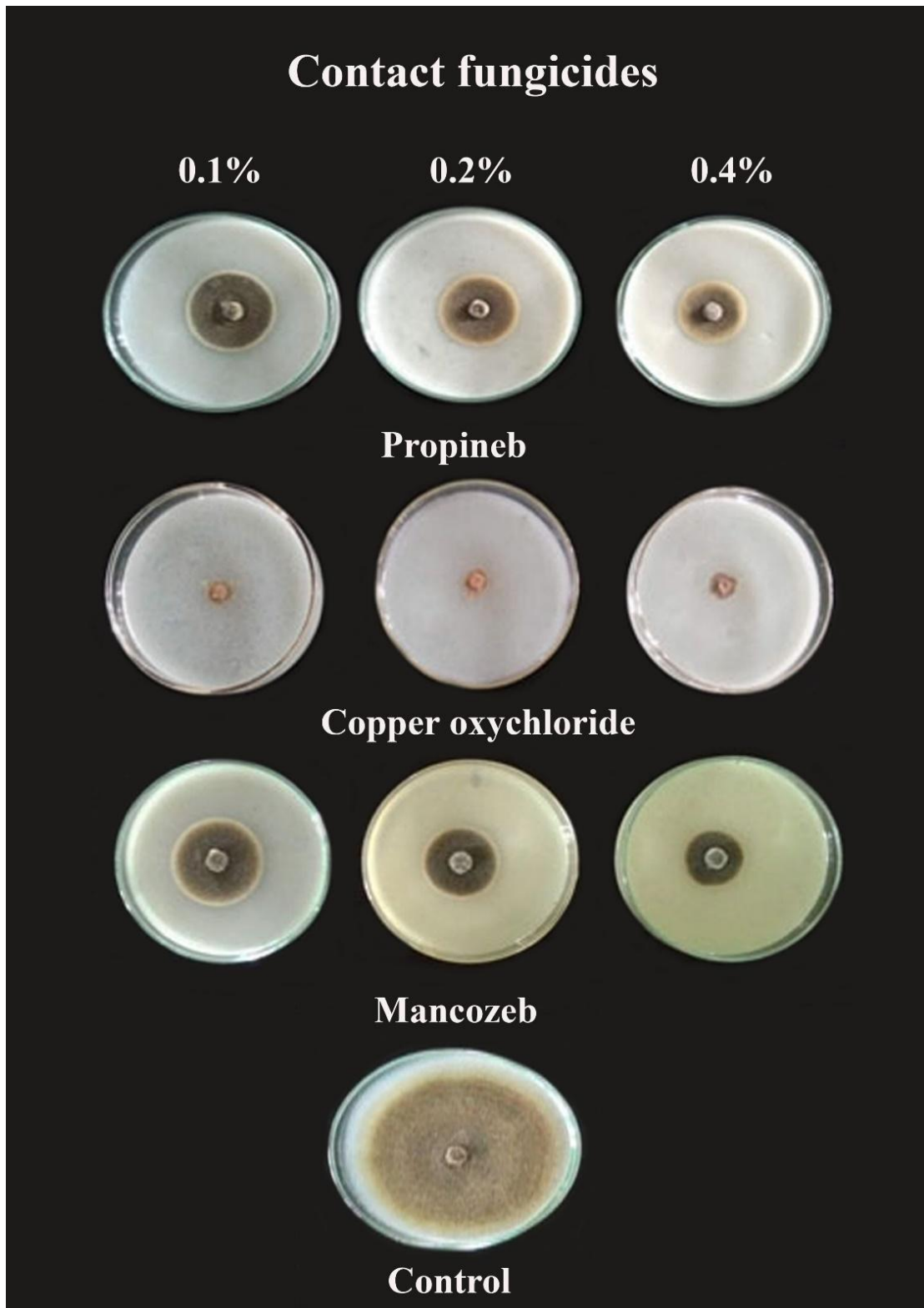


Table.1 *In vitro* efficacy of fungicides against *A. brassicicola*

Fungicide	Per cent inhibition of mycelial growth			Mean
	0.05%	0.1%	0.2%	
Propiconazole	100 (89.04)	100 (89.04)	100 (89.04)	100
Tebuconazole	100 (89.04)	100 (89.04)	100 (89.04)	100
Hexaconazole	100 (89.04)	100 (89.04)	100 (89.04)	100
Azoxystrobin	27.7 (31.75)	31.1 (33.89)	33.3 (35.24)	30.7
	0.1%	0.2%	0.4%	
Propineb	50 (45)	61.1 (51.41)	66.6 (54.69)	59.23
Copper oxychloride	100 (89.04)	100 (89.04)	100 (89.04)	100
Mancozeb	51.1 (45.63)	62.2 (52.06)	69.96 (56.77)	61.08
Mean	75.54	79.2	81.40	78.71
CD (P 0.01)	1.421	1.754	1.775	
S. Em±	0.277	0.338	0.345	

Values in parenthesis are arc sin transformed.

Of the three contact fungicides tested at three different concentrations (0.1%, 0.2%, 0.4%) against *A. brassicicola* revealed that mycelial growth was completely inhibited with copper oxychloride followed by mancozeb (51.1%, 62.2%, 69.96%) and least inhibition with propineb (50%, 61.1%, 66.6%) at 0.1%, 0.2% and 0.4% concentrations respectively. Ansari *et al.*, (1990) reported that the fungicides Blitox-50, Difoltan-80, Dithane Z-78 and Ziram completely inhibited the growth of *Alternaria brassicae*.

Based on the above results it was clear that the fungicides propiconazole, hexaconazole, tebuconazole and copper oxychloride were effective against *A. brassicicola* the incitant of alternaria leaf spot of cabbage.

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