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Efficacy of different fungicides against *Alternaria brassicae* caused *Alternaria* leaf spot of cauliflower

Ajad Patel, Ram Chandra and Manu Upadhyay

Abstract

Cauliflower (*Brassica oleracea*) is most important vegetable crop and several bacteria, fungi and virus infect it and cause diseases. *Alternaria* leaf spot of cauliflower is very worst disease and distributed worldwide in all cauliflower growing countries. This disease is caused by *Alternaria brassicae* and pathogen affects the curd of cauliflower and yield. Earlier several studies have been conducted for management of cauliflower in which several fungicides have used against *Alternaria brassicae* and few are highly effective. Therefore present investigation was conducted on efficacy of different fungicides against *Alternaria brassicae* caused *Alternaria* leaf spot of cauliflower. Five fungicides viz. Azoxystrobin (Onestar 23% SC), Carbendazim (Dhanustin 50% WP) Kasugamycin (Kasu B 3% SL), Fusilazole (Cursor 40% EC) and Pyraclostrobin + Metaram (Carbrio Top 60% WG), were assayed at two concentration 300ppm and 550ppm for their efficacy against *Alternaria brassicae* by Poison food technique. Fusilazole (Cursor 40% EC), was found highly effective against pathogen at both concentration. Another (Cambio Top 60% WG) Pyraclostrobin + Metaram was also found to be effective against pathogen and showed 70% inhibition at 550ppm concentration and 63% at 300ppm concentration. Minimum mycelia inhibition was recorded with Azoxystrobin (Onestar 23% SC), with only 61% inhibition at 550ppm concentration. This investigation will be helpful to the farmers for selection of suitable fungicides, used as a control of *Alternaria* leaf spot of cauliflower.

Keywords: Cauliflower, *Alternaria brassicae*, fungicides, poisoned food technique, toxicity

Introduction

Cauliflower is one of several vegetables in the species *Brassica oleracea*, in the family Brassicaceae. It is an annual plant that reproduces by seed. Typically, only the head (the white curd) of aborted floral meristems is eaten, while the stalk and surrounding thick, green leaves are used in vegetable broth or discarded. Its name is from Latin *caulis* (cabbage) and *flower*, an acknowledgment of its unusual place among a family of food plants which normally produces only leafy greens for eating. *Brassica oleracea* also includes cabbage, Brussels sprouts, kale, broccoli, and collard greens, though they are of different cultivar groups.

Fungal disease of cauliflower

There are so many fungi which are responsible for the cruciferous crop diseases like-Damping-Off and Wire-Stem, Black-Leg, Club-Root, Fusarium Yellows, Sclerotinia Blight, Downy Mildew, *Alternaria* Leaf Spot. The pathogens viz., *A. brassicae* and *A. brassicicola* are worldwide in occurrence on *Brassicaceae*. On cauliflower crop itself, the disease has caused significant losses in Australia, Bangladesh, Brazil, China, England, Finland, France, Geneva, Germany, India, Israel, Italy, Japan, Korea, Malaysia, Pakistan, Sri Lanka and Taiwan. In India, cauliflower is grown on large average and the major growing states of India are Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, Uttaranchal and West Bengal.

Many fungicides have been tested for effectiveness in controlling *A. brassicae* and conclusions are often conflicting. Ansari *et al.* (1990) [1] evaluated eighteen fungicides as to their control of *A. brassicae* in artificial cultures, infected seeds, and as a foliar spray on infected plants of *B. campestris* var. *yellow sarson* (a highly susceptible rape cultivar). Throughout the study Dithane M-45 (Mancozeb) and Dithane Z-78 (Zineb) consistently provided the best control data. Seven fungicides completely inhibited the growth of the pathogen in culture: Benlate at 0.1 lba.i./100 gal, Dithane M-45, Dithane Z-78, Ziram, Difolatan-80 and Thiram (all at 0.2 lba.i./100 gal), and Blitox-50 at 0.3 lba.i./100 gal. As a seed dressing, Benlate at 0.1 lba.i./100 lb seed provided the best control with a mean loss of 4.5 pre-emergence seedlings and 6.5 post-emergence seedlings per pot (25 seeds planted in each pot, 8 pots).

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Dithane M-45 and Dithane Z-78, both applied at 0.2 lba.i./100 lbs seed, had a mean pre-emergence seedling loss of 10.5 and 11.25, respectively and post-emergence seedling loss of 11.5 and 13.75, respectively. As a foliar spray, Dithane M-45 (0.2 lba.i./100 gal) provided significantly better control over other fungicides, including Benlate. Dithane M-45 gave better results than Dithane Z-78 (0.2 lba.i./100 gal), although the difference was not significant. Plants treated with these two fungicides also provided the highest seed yields.

Iprodione and fenpropimorph have both shown high inhibitory properties to the growth of *Alternaria* sp. in culture and as seed treatments at 0.25 lba.i./100 lb seed (Maude *et al.*, 1984) [4]. In seed samples with up to 61.5% infection (35.5% internally diseased), iprodione usually eliminated the fungus from the sample, but higher levels of infection required a larger dose of iprodione. The germination of healthy seeds was unaffected by treatment, and diseased seed germination

improved (Maude and Humpherson-Jones, 1980 a, b). Surface treatment with thiram at 0.55 lb/100 lb seed controlled *A. brassicicola*, but did not control internal infections of *A. raphani* (Valkonen and Koponen, 1990) [7].

Although, earlier several studies have been conducted for management of cauliflower in which several fungicides have been used against *Alternaria brassicae* and few are highly effective. Keeping in view the present investigation was undertaken for "Efficacy of different Fungicides against *Alternaria brassicae*."

Materials and Methods

The present investigation was carried out during Rabi season 2018 at the Department of Mycology and Plant Pathology, Institute of Agriculture sciences, Banaras Hindu University, Varanasi.

Table 1: The list of fungicides, used against *Alternaria brassicae*.

Fungicides	(Trade name)	Amount Required (in 100ml.) To Make (5000ppm.)stock solution
Azoxystrobin	(Onestar 23% SC)	2.17ml.
Carbendazim	(Dhanustin 50% WP)	1.0g
Kasugamycin	(Kasu B 3% SL)	16.6ml.
Fusilazole	(Cursor 40% EC)	1.25ml.
Pyraclostrobin + Metaram	(Cabrio Top 60% WG)	0.83g.

Five fungicides, viz. Azoxystrobin (onestar 23% SC), Carbendazim (Dhanustin 50% WP), Kasugamycin (kasu B 3% SL) Fusilazole (Cursor 40% EC) and Pyraclotrobin ± Metaram (Cabrio Top 60% WG) were assayed for their efficacy against *Alternaria brassicae* under *in vitro* condition. These fungicides were tested at 300ppm and 550ppm concentration using poisoned food technique (Nene and Thapliyal, 1993). First of all stock solution of 5000ppm of each fungicide were made. The desired concentration was obtained by adding of appropriate amount of stock solution of fungicides to PDA medium in separate volumetric flask. PDA without fungicide served as control. Each plate was inoculated with a 5 mm mycelia disc of the pathogen (*Alternaria brassicae*). The inoculated plates were incubated in B.O.D. incubator at 27 ± 1°C till the fungus cover the whole plate in control. The radial growth of pathogen were recorded and per cent inhibition of each treatment was calculated by using following formula

$$\% \text{ inhibition} = \frac{C-T}{C} \times 100$$

Where, C= Control & T= Treatment

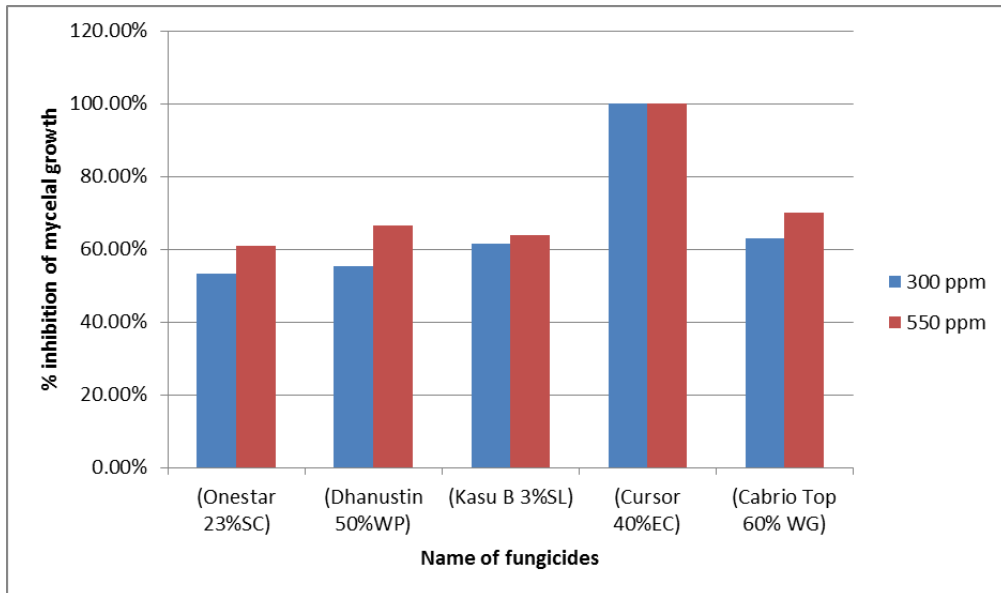
The desired concentrations of fungicides were obtained by adding appropriate amount of stock solution of fungicides to PDA medium in separate volumetric flask. The equation used for the calculation of concentration is $M_1V_1=M_2V_2$, where M_1 is the concentration of the concentrated solution (stock solution), V_1 is the volume of the concentrated solution (stock solution), M_2 is the concentration of the dilute solution (after more solvent has been added) and V_2 is the volume of the dilute solution.

Results and Discussion

The result showed that (Table 1) Fusilazole (Cursor 40% EC), was found highly efficient in controlling the growth of *Alternaria brassicae* at both concentration viz. 300 ppm and 550 ppm. Maximum mycelia growth inhibition was recorded from Fusilazole (Cursor 40% EC), followed by Cabrio Top 60% WG (Pyraclostrobin + Metaram), (Kasugamycin) Kasu B 3% SL, (Carbendazim) Dhanustin 50% WP and (Azoxystrobin) Onestar 23% SC at 300ppm. The mycelial inhibition percentages were 100%, 63%, 61.4%, 55.5% and 53.28% respectively.

At 550 ppm, maximum mycelia growth was inhibited from (Fusilazole) Cursor 40% EC, followed by Cabrio Top 60% WG, (Kasugamycin) Kasu B 3% SL, (Carbendazim) Dhanustin 50% WP and (Pyraclostrobin + Metaram) (Azoxystrobin) Onestar 23% SC. The mycelial inhibition percentages were 100%, 70%, 66.67%, 64% and 61.05% respectively.

The result was found to be confirmative with the finding of Mishra *et al.* (2009) [6] they have reported seven fungicides against *Alternaria brassicae*. This finding also confirmative with result of Ansari *et al.* (1990) [1] they have evaluated eighteen fungicides as to their control of *A. Brassicae* in artificial cultures and Dithane M-45 (Mancozeb) and Dithane Z-78 (Zineb) consistently provided the best control data. Seven fungicides completely inhibited the growth of the pathogen in culture.



Graph 1: Efficacy of different fungicides against *Alternaria brassicae*

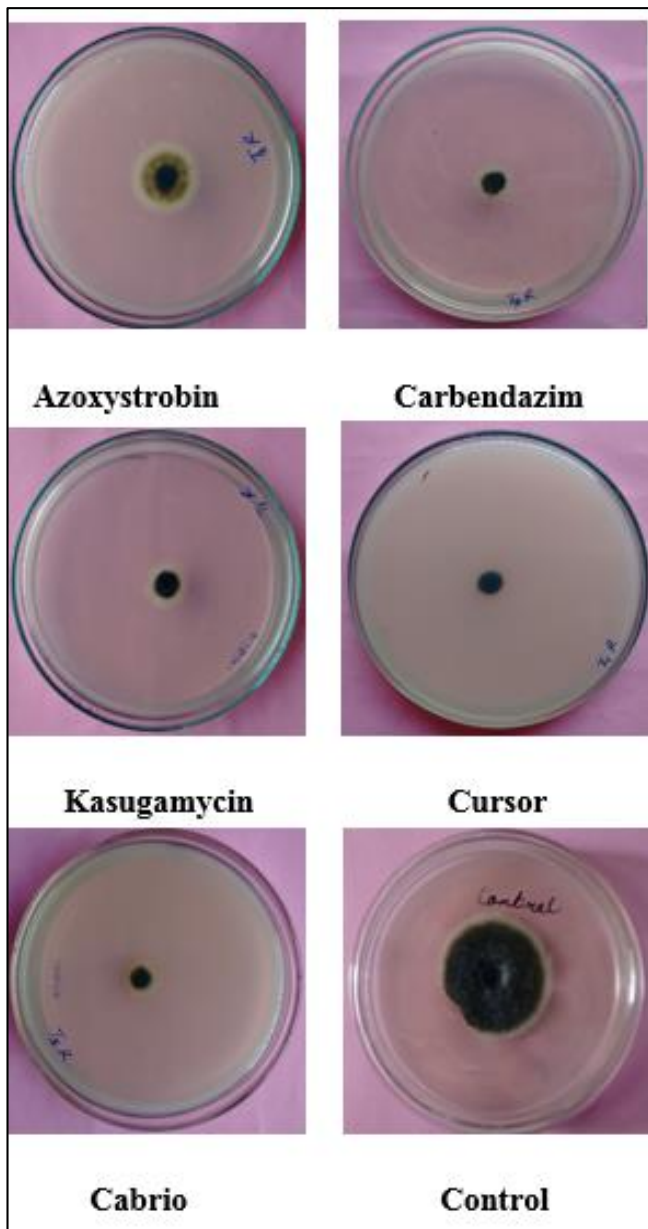


Fig 1: Efficacy of different fungicides on radial growth of *Alternaria brassicae* at 300ppm

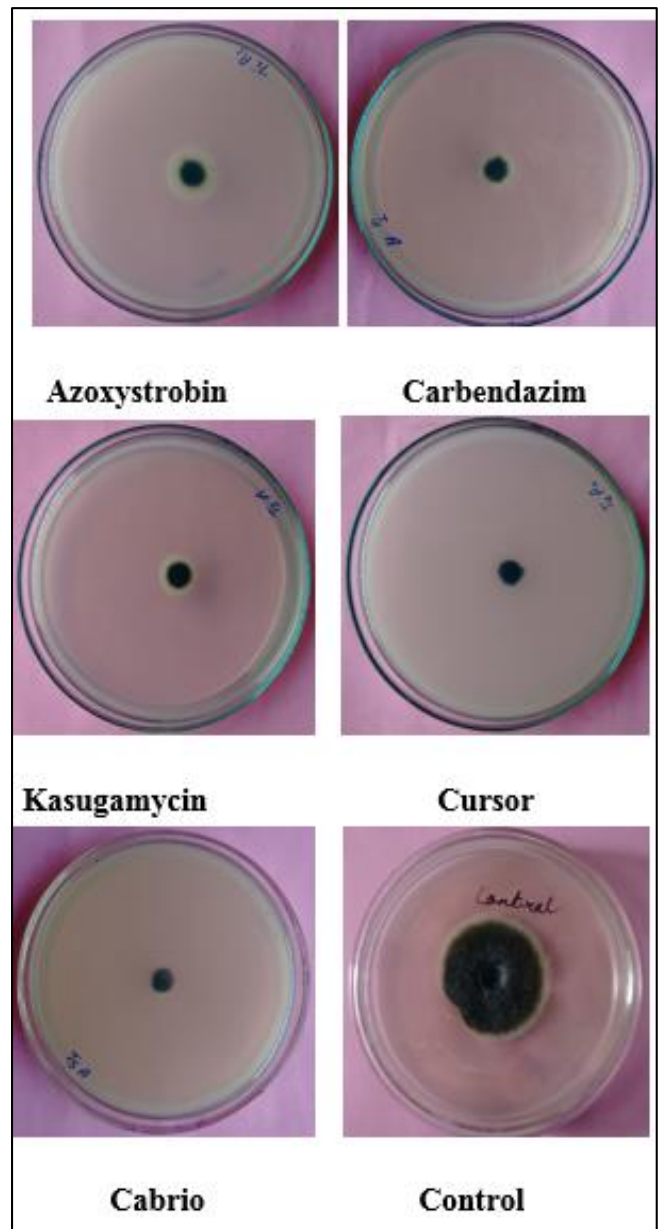


Fig 2: Efficacy of different fungicides on radial growth of *Alternaria brassicae* at 550ppm

Conclusion

Cauliflower (*Brassica oleracea*) is most important vegetable crop and several bacteria, fungi and virus infect it and cause diseases. Alternaria leaf spot of cauliflower is very worst disease and distributed worldwide in all cauliflower growing countries. This disease is caused by *Alternaria brassicae* and pathogen affects the curd of cauliflower and yield. Presently many farmers are using fungicides for control of Alternaria leaf spot of cauliflower. However, farmers are unable for select suitable fungicides for control of this disease. There are different fungicides and chemicals available in the market for control of alternaria leaf spot of cauliflower. However, some fungicides are highly effective and some fungicides are less effective against pathogen. Therefore, this investigation will be helpful to the farmers for selection of suitable fungicides, used as a control of Alternaria leaf spot of cauliflower.

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