RESEARCH ARTICLE

SYMPTOMS AND MANAGEMENT OF ALTERNARIA BLIGHT OF INDIAN MUSTARD (*BRASSICA JUNCEA*)

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Abstract: Mustard is the major oilseed crop in the world. Many biotic and abiotic stresses are liable for reducing quantity and quality of mustard crop. Among biotic stress, Alternaria blight is one of the most destructive fungus disease of mustard which caused by *Alternaria brassicae* and *Alternaria brassicicola*. The symptoms of *A. brassicae* appear on whole pats of plant viz., leaves, stems and pods. The PBR-97 variety showed early symptoms at 21 days after sowing (DAS) whereas, Giriraj showed the late symptoms at 34 DAS. Mancozeb show the maximum diameter of zone of inhibition at different concentration (125, 250, 500, 1000 ppm) followed by ridomil and carbendazim. *Allium sativum* give best and swift result than *Azadirachta indica*. Botanical control is the alternative approach for management of disease that is eco-friendly and reduces the harmful impact on human and animal health.

Keywords: Alternaria blight, *Alternaria brassicae*, Fungicides, Management, Mustard

INTRODUCTION

Mustard (*Brassica juncea* L.) is belong to family Brassicaceae and third important sources of vegetable oil randomly after soybean (*Glycine max L.*) and palm (*Elaeis guineensis jacq.*) all over the world. In India, mustard is the 2nd most important edible oil crop after groundnut 27.8 % share of oil production in the India. Mustard crop are grown in both tropical and subtropical countries. In world, Rapeseed and mustard cultivate on 26.09 million hectares area with 571,880 tonnes production (FAO, 2015). In India, mustard occupies 6.42 million hectares area and 6.33 million tonnes production (Anonymous, 2017-2018). In India under Punjab region, Rapeseed-mustard are grown in *Rabi* season (mid September to November and harvested during last February to end March). Mustard crop require between 10□ C - 25□ C temperature and having a rainfall is 25-40 cm per year.

Alternaria blight is widely distributed disease in all mustard cultivated areas. Alternaria blight cause highly yield loss 15-71 per cent in productivity with 14-36 per cent decrease in oil content (Meena *et al.*, 2010). The symptoms of *A. brassicae* appear on leaves and stem and adult plants also in siliquae during ripening stage. Dark spots are appears on leaves and siliquae with adversely affect on seed production and quality of mustard (Kumar *et al.*, 2014). Pod infection is major factor to reduce seed yield and control pod infection is necessary to increase seed yield (Hossian and Mian, 2004). Protection of seedpod from Alternaria blight infection should be most important aim for higher yield. The most economic and eco-friendly save method to control disease use resistant varieties. The information of resistant varieties source are not available, but some sort of tolerance may be available (Shah *et al.*, 2005, Rajendra *et al.*, 2002).

To check the antifungal properties of use different plant species at 2 and 5% concentration against *A. brassicae in vitro.* They reported maximum control of mycelia growth with the extract of *A. sativum* at both concentrations, followed by the extracts of *Lawsonia inermis* (30.0%), *Erythrina chiapasana* (25.5%), *Ricinus communis* (16.8%) and *Z.officinale* (16.3%) at 5% each. (Meena and Sharma, 2012). Sunder *et al.*, (2005) test that Mancozeb and Iprodione have high reduce disease incidence and increase crop yield. The efficacy of various botanicals and fungicides to control *A. brassicae* in India mustard (cv. Varuna) from all over the treatments Mancozeb give best result to control disease and increase seed yield (Nigam *et al.*, 2011).This work aims to examine the symptoms of Alternaria blight on the different parts of *B. juncea* and check the antifungal activity of fungicides and botanicals against *A. brassicae.*

MATERIALS AND METHODS

The experiment was conducted at Guru Kashi University Agriculture farm, Talwandi Sabo during 2018–2019, in a split plot design and different four varieties of *B. juncea* (PBR-97, Varuna(T-59), Giriraj (2017) and Parasmani 2) with three replications, were sown on two sowing dates standard spacing and use recommended doses of N, P and K fertilizers in natural conditions.

Visual observations were made for manifestation of the Alternaria blight typical symptoms on field growing mustard plants from the experimental area, collect infected leaves in polythene bags, brought to the laboratory and subjected to the isolation on Potato Dextrose Agar medium PDA) medium. Isolation done in sterilized Petri dishes under

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Laminar-air-flow cabinet and incubated these plates in BOD incubator at 25±2°C temperature. Subsequently 5-7days of incubation, well developed mycelial growth was obtained. Use different laboratory equipment's to isolation and of pathogen *viz.*, Autoclave, Hot air oven, Hot plate, Laminar airflow Cabinet, BOD Incubator, Refrigerator, Binocular Microscope, Haemocytometer, Distillation unit, Water bath, Deep freezer (-20°C) ,Electronic balance, Variable volume micropipettes, etc. available in the Department of Plant Pathology, College of Agriculture, were used. The common glass-wares (Borosil) *viz.*, Petri-dishes, test tubes, conical flasks, volumetric flasks, measuring cylinder, L Shape Spreader, beakers, funnel, pipette etc. The glassware's were cleaned and sterilized.

The botanicals are use to control the *A. brassicae* in mustard. Neem oil (Azadirachtin 0.03%), garlic extract (1gm garlic: 10ml distilled water) following botanical doses were used during present study. The fungicides used in this experiment are ridomil gold (Metalaxyl 4% + Mancozeb 64% WP), mancozeb 75% WP and carbendazim 50% WP **.**To control the pathogen growth well diffusion method was use on the solid agar media in Petri dishes Schillinger and Lucke (1989).

RESULTS AND DISCUSSION

Symptomatology

Symptoms of the Alternaria blight were characterized by evolution of spots on leaves, stem and siliquae. *A. brassicae* was affected host plants at all stages of growth, along with seedling. It first symptoms are appear on the lower leaves in the form of small light brown to blackish in color, circular or irregular lesions, which later on turns black due to the appearance of spore masses, with disease evolution symptoms are show on the upper leaves, stem and siliquae of plant. These spots enlarged and combine forming large sized spots. In some cases, centre of these spots light brown dot surrounded by the number of dark alternating concentric rings also appeared. The symptoms of rapeseed-mustard Alternaria blight observed in present studies were also reported earlier by Nayyar *et al.,* (2014).

In the *Rabi* season (2018-2019) PBR-97 and Parasmani-2 showed the earliest occurrence of the symptoms on cotyledon leaves of few plants. In the first sowing appearance of Alternaria blight on leaves in the form of pinhead was first recorded in PBR-97 in 14th November followed by Parasmani-2, T-59 (Varuna) and Giriraj in 21th November, 23th November and 16th November sowing respectively. The PBR-97 variety showed early symptoms at 21 DAS whereas, Giriraj showed the late symptoms at 34 DAS (Table.1). The phenotypic symptoms of Alternaria blight on different parts of *B. juncea* (Fig. 1) were evaluated.

Table 1. The disease appearance on the varieties at different sowing dates.

Date of sowing	Varieties	Initial appearance of the disease (DAS)
D1(22/10/2018)	V1	24(46th week)
	V2	32 (47th week)
	V3	34 (47th week)
	V4	26 (46th week)
D2 (05/11/2018)	V1	21(47th week)
	V2	28 (48th week)
	V3	32 (49th week)
	V4	26 (48th week)

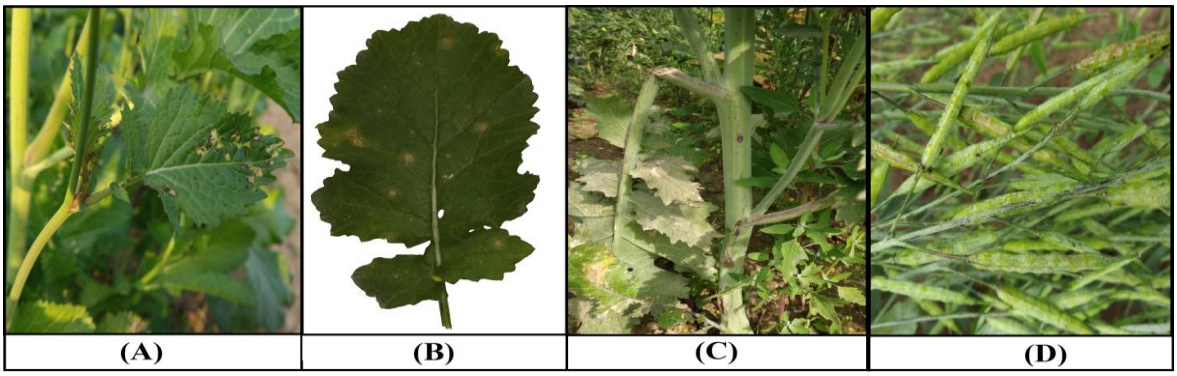

Fig. 1. Typical symptoms of Alternaria blight on different parts of Indian mustard. (A) Initial symptoms (B) Formation of concentric rings (C) Spots on stem (D) Spots on pods.

Identification

A. brassicae having brown colored septate mycelium. Conidiophores are dark olive, septate, geniculate, with a prominent scar at each geniculate. Chains of Conidia were formed in agar cultures, obclavate, with a conspicuous beak, smooth, grayish-olive with cross septa and longitudinal ones, slightly constricted at the septa.

For identify the isolated pathogen, morphological characters were studied on Potato-dextrose agar (PDA) medium, under a compound microscope. The morphological observations of the fungus are given below (Fig. 2).

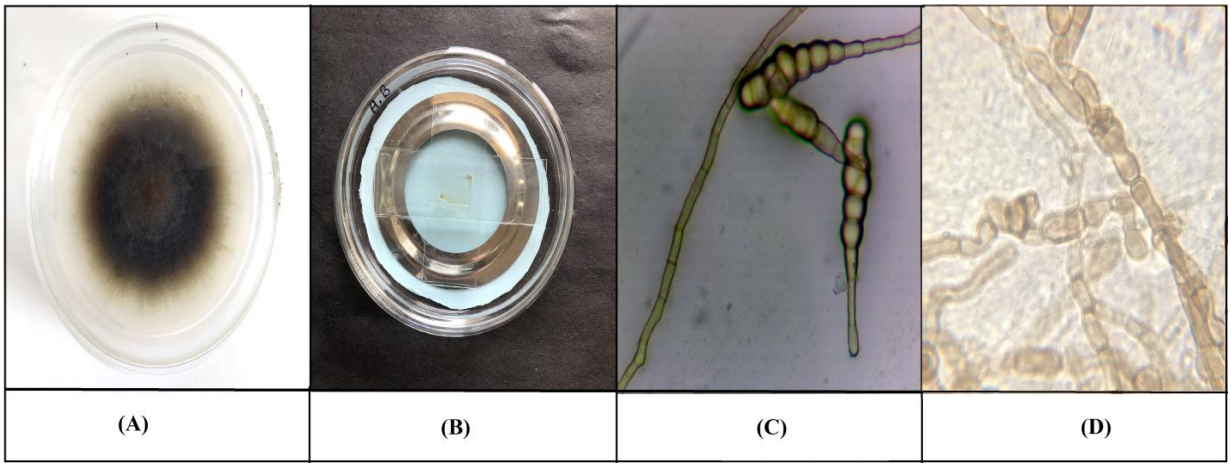

Fig. 2. (A) Morphology of *A. brassicae* on PDA (B) Slide culture (C) Structure of spores and Septate hyphae (D) Chain of conidia.

Effect of chemicals against Alternaria blight

The fungicides *viz.*, Mancozeb, Ridomil, Carbendazim and Control were evaluated under *in-vitro* conditions. The fungicides were use at four different concentrations viz., 125ppm, 250ppm, 500ppm, 1000ppm to check the antifungal activity of fungicides by use of well diffusion method. In this technique make 5 mm diameter well in solid pored medium (PDA) with sterile cork borer. Use 150 µl quantity of fungicides to fill in the well at all concentrations and pathogen solution was spread on the surface of the cultivated PDA with spreader and incubate at 25±2°C temperature in BOD for 5-7 days. Measure the diameter of zone (in mm) of inhibition around the well after proper growth of *A. Brassicae* (7 days from date of treatment). The data is summarized in Table-2 and Fig-3. All the chemicals were significantly superior control. Suitable control (without fungicide) was also maintained. At 7th days after inoculation, mancozeb was significantly superior result then other fungicides. Zone of inhibition pictures are show in Fig. 4.

At 125 ppm concentration, maximum diameter of zone of inhibition was recorded in mancozeb (12mm) followed by ridomil (11.25mm), carbendazim (5mm). At 250 ppm concentration the highest diameter of zone of inhibition was recorded in mancozeb (13.25 mm) followed by ridomil (12.25 mm), carbendazim (11.25 mm). Similarly as at higher concentration of 500 and 1000 ppm mancozeb was significantly superior over all other fungicides in increase diameter of zone of inhibition, at these concentrations ridomil was significantly superior over carbendazim in increase diameter of zone of inhibition around the well. Mancozeb proved to be the most effective fungicide in controlling Alternaria blight at all concentrations. These results also support the finding of Nigam *et al.*, (2011).

Table 2. Zone of inhibition (diameter in mm) of different fungicides against *A. brassicae*

S.No.	Treatmens	Diameter (in mm) of zone of inhibition				Overall Mean (in mm)
		Concentration (in ppm)				
		125	250	500	1000	
1	Mancozeb	8	9.25	14.50	29.50	**15.31**
2	Ridomil	7.25	8.25	12.50	13.75	**10.44**
3	Carbendazim	1	5.50	8	11.75	**6.56**
4	Control	0				**0**

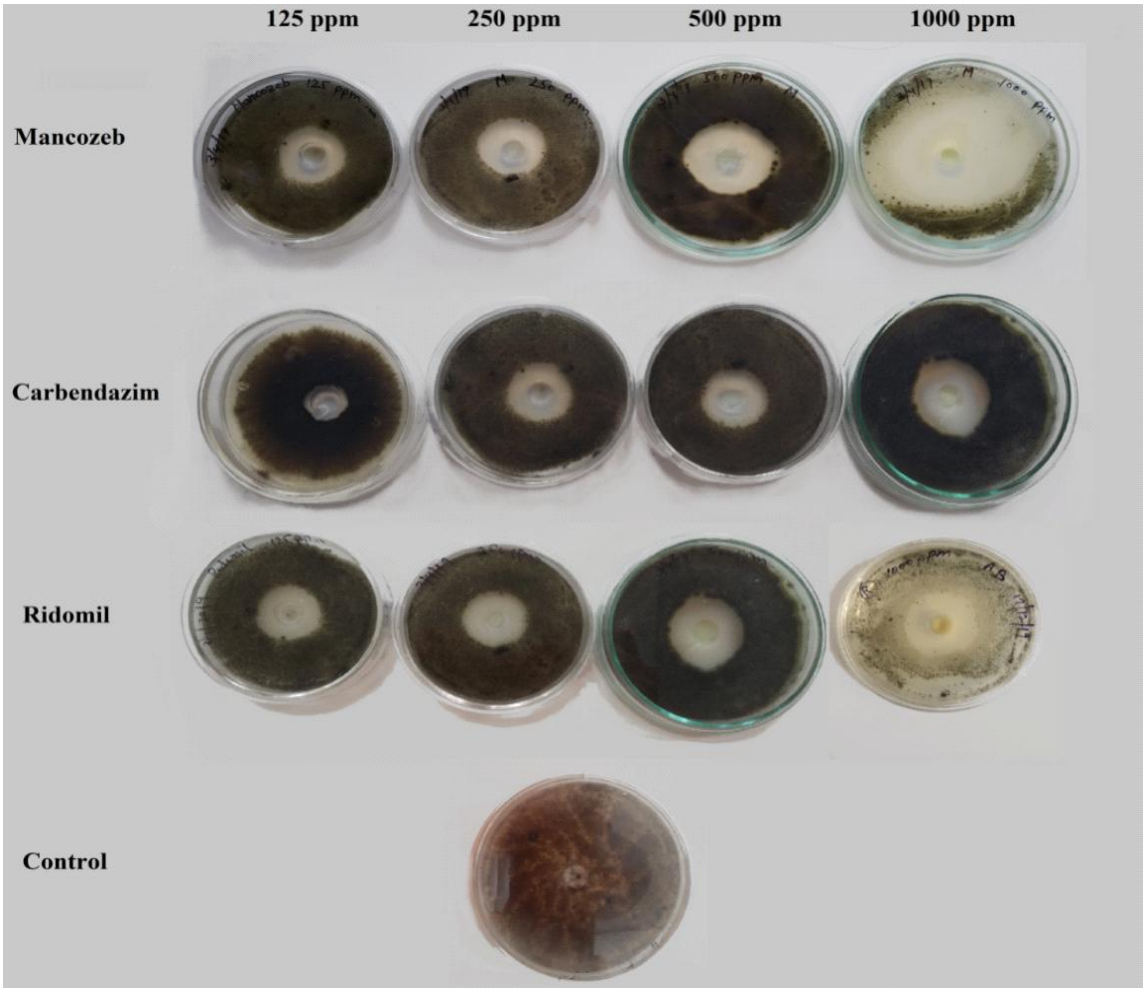

Fig. 3. Zone of inhibition (diameter in mm) of different fungicides against *A. brassicae*.

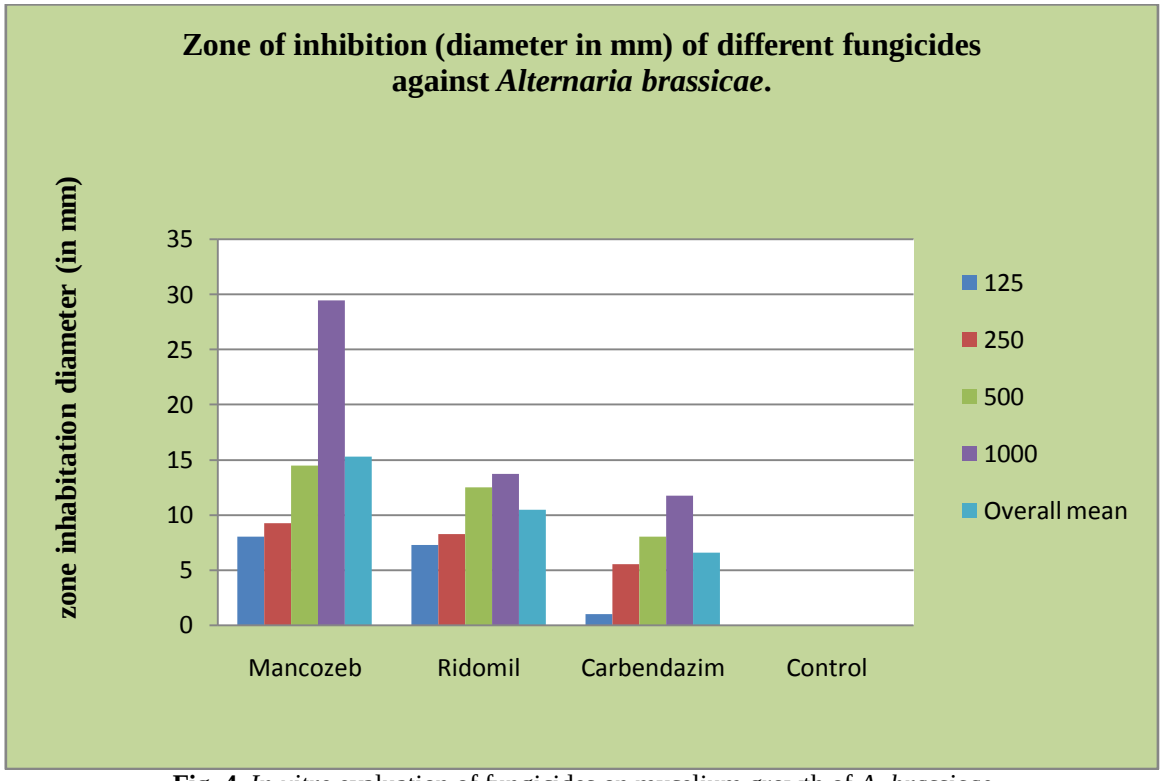

Fig. 4. *In-vitro* evaluation of fungicides on mycelium growth of *A. brassicae*

Effect of botanicals against Alternaria blight

The two botanicals *viz.*, *A. sativum* and *A. indica* were evaluated under *in-vitro* conditions. *A. indica* use at different concentrations (125, 250, 500, 1000 and 1500 ppm). 150 µl concentration of neem oil were use to fill in well for all concentrations. *A. sativum* use at different concentrations (25, 50, 75, 100 and 150µl). Well diffusion method was using in botanical control same as fungicide treatment. After fill the botanical concentration in well and spread the pathogen on the surface of cultivated PDA with spreader and incubate at 25±2°C temperature in BOD for 5-7 days. Measure the diameter of zone (in mm) of inhibition around the well after proper growth of *A. brassicae* (7 days from date of treatment). *A. indica* give very low antifungal activity against *A. brassicae*. During *A. indica* experiment diameter (in mm) of zone of inhibition recorded at 125, 250, 500, 1000 and 1500 ppm were 5, 5, 9.75, 16.50 and 18.50 mm respectively and *A. sativum* show highest diameter of zone inhibition (in mm) with 25, 50, 75, 100 and 150 were 16.25, 25.50, 28.25, 29.75 and 31.25 mm respectively. According to visual appearance *A. sativum* give swift and best result than *A. indica* (show in Fig.5). These results are in agreement with the earlier studies like Meena and Sharma, (2012).

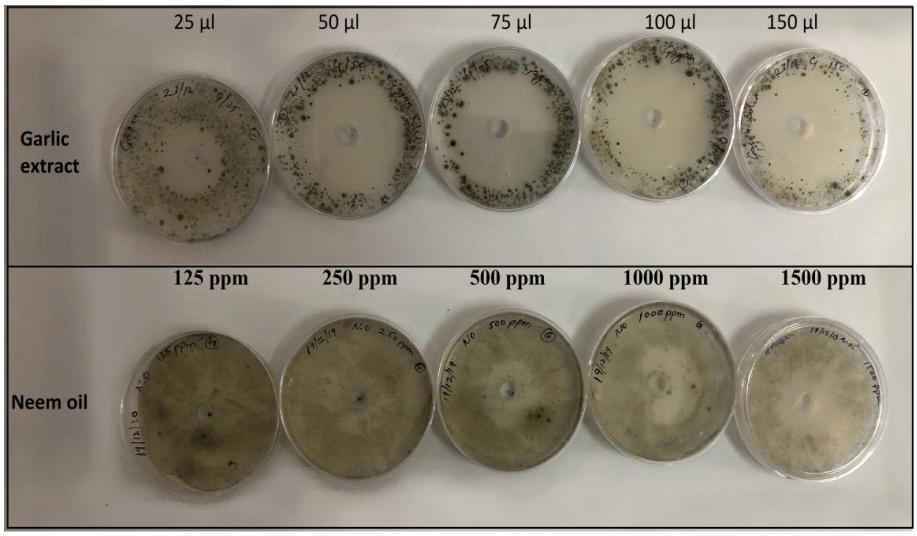

Fig. 5. *In-vitro* evaluation of botanicals on mycelium growth of *A. brassicae*

CONCLUSION

PBR-97 and Parasmani-2 showed the earliest occurrence of the symptoms on cotyledon leaves of few plants. Mancozeb proved to be the most effective fungicide in controlling Alternaria blight at all concentrations. *A. sativum* show highest diameter of zone inhibition (in mm) with 25, 50, 75, 100 and 150 µl were 16.25, 25.50, 28.25, 29.75 and 31.25 mm respectively. *A. indica* show very low antifungal activity against *A. brassicae*. Use botanicals to control Alternaria blight disease, they are safe for human, animals and environment. Over the past 50 years, the use of chemical fertilizers, pesticides and good agronomical practices enabled growers to maintain improved crop productivity. However, excess use of Fertilizers and pesticides during the last few decades in controlling pests and diseases resulted in negative impacts on the environment, producing inferior quality and harmful for consumer health. In recent times, alternate approaches are being used to manage and mitigate a variety of pathogens for control of plant diseases. Botanical control is the alternative approach for management of disease that is good eco-friendly and without any harmful impact on environment.

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