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Efficacy of Newer Molecules of Fungicides against *Alternaria brassicae in vitro*

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A B S T R A C T

Rapeseed-mustard belongs to family Brassicaceae. It is the most important group of *rabi* oilseed crops and contribute a major share to the vegetable fat of the country. Effectiveness of the six fungicides *i.e.* Quintal (Iprodione 25% + Carbendazim 25%), Nativo (Tebuconazole 50% + Trifloxystrobin 25% 75GW), Tilt (Propiconazole 25 EC), Score (Difenoconazole 25 EC) and Propineb (Antracol 70 WP), Folicur (Tebuconazole 250 EC) were used at three concentrations of each @ 0.05, 0.1 and 0.2 per cent and one is no treatment (control) under *in vitro* against *Alternaria brassicae* by poison food technique. At 0.05% concentration of fungicides the minimum growth was recorded in Iprodione 25% + Carbendazim 25% (47.47mm) followed by Propineb 70 WP (52.56mm) had significantly reduced the mycelia growth of tested pathogen by food poison technique than the control (90.00mm). In case of 0.1% concentration of fungicides the minimum growth was recorded in Iprodione 25% + Carbendazim 25% (38.09mm) followed by Propineb 70 WP (43.00mm) had significantly reduced the mycelia growth of tested pathogen than the control (90.00mm). In case of 0.2% concentration of fungicides the minimum growth was recorded in Iprodione 25% + Carbendazim 25% (27.84mm) followed by Propineb 70 WP (30.84mm), had significantly reduced the mycelia growth of tested pathogen than the control (90.00mm). Four treatments namely Tebuconazole 250 EC + Trifloxystrobin WG 75; Propiconazole 25 EC; Difenoconazole 25 EC and Tebuconazole 250 EC were tested by poison food technique *in vitro* and result cent per cent restriction of radial growth of *Alternaria brassicae* in 0.05%, 0.1% and 0.2% concentration.

Introduction

Rapeseed-mustard belongs to family Brassicaceae, which is grown in northern India comprising traditionally grown indigenous species namely Indian mustard (*B. juncea*), brown *sarson* (*B. campestris* var. brown *sarson)*, yellow *sarson* (*B. campestris* var. yellow *sarson*), toria *(B. campestris* var. toria), taramira (*Eruca sativa)*, gobhi *sarson* (*B. napus*), white mustard *(B. alba)* and Ethiopian mustard (*B. carinata*). It is the most important group of *rabi* oilseed crops and contribute a major share to the vegetable fat of the country. Oil and fats comprise a vital component of human diet as these are good

source of energy and act as carriers of fat soluble vitamins. The seeds are highly nutritive containing eruic acid (0-52.56%), linoleic acid (6.30-41.80%) and oleic acid (2.91-45.02%), eicosenoic acid (0.0-17.61).

Oil cake or meal is used as a source of protein in animal feeds (Singh *et al.,* 2011). Among the major growing countries of rapeseed-mustard worldwide, India, Canada, China, Pakistan, Bangladesh, Germany, France, Sweden and Poland. In India, it had the area of 5.96 Million hectares with production of 8.32 Million Tonnes and productivity of 1397 Kg/hectare. In India, its cultivation is mainly confined to U.P., M.P., Rajasthan, Haryana, Assam, Gujarat, Jharkhand, Bihar, Punjab and West Bengal. State wise in U.P. it was grown on 0.68 Million hectares with production of 0.95 Million Tonnes and productivity of 1392 Kg/ha and ranked third after M.P. and Rajasthan for area and second in production after Rajasthan (Anonymous, 2018). Behind the lower productivity of the crop, a number of fungal foliar diseases are most important.

This crop suffers from devastating diseases such as Alternaria blight, white rust, downy mildew, powdery mildew, bacterial rot and wilt (Kolte, 1985 and Singh *et al.,* 2019). Among the diseases Alternaria blight caused by *Alternaria brassicae* (Berk) Sacc, are also widely prevalent diseases in Eastern Uttar Pradesh (Singh and Singh (2005) and Kumar *et. al.* (2016).

The blight also reduces seed size and impairs seed colour and oil content. In the absence of resistant cultivars, fungicides (Singh and Singh, 2005) provide the most reliable means of disease control. The efforts were made to search efficacious fungicides, for the management of this disease against the blight causing pathogen *(Alternaria brassicae).* Results of are being reported here.

Materials and Methods

Infected mustard leaf showing characteristic symptoms of *Alternaria brassicae* were collected from experimental field at Student Instructional Farm situated at main campus of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) for isolation and identification. The infected plant parts were cut in to small pieces and surface sterilized with 0.1 per cent mercuric chloride ($HgCl_2$) solution and washed thoroughly 3 to 4 times with sterilized water to remove the traces of $HgCl_2$. The pieces were transferred in Petridishes containing potato dextrose agar and incubated at 25^0C for 6 days. Effectiveness of the six fungicides *i.e.* Quintal (Iprodione 25% + Carbendazim 25%), Nativo (Tebuconazole 50% + Trifloxystrobin 25% 75GW), Tilt (Propiconazole 25 EC), Score (Difenoconazole 25 EC) and Propineb (Antracol 70 WP), Folicur (Tebuconazole 250 EC) were used at three concentrations of each @ 0.05, 0.1 and 0.2 per cent. Each concentration of fungicide was bio-assayed against the test pathogen under laboratory condition to find out their relative efficacy for inhibiting the mycelial growth of the pathogen in culture by poison food technique. Requisite quantity of each fungicide was incorporated in 100 ml PDA and mixed thoroughly by sacking, prior to pouring into Petriplates.

After the pouring of PDA in Petriplates, the medium was allowed to solidify and these plates were centrally inoculated with the 6 mm diameter disc of pathogen which is cut by sterilized cork borer, taken from the margin of actively growing 7 days old culture. Control was used as such without adding fungicide in the medium. Four replications of each treatment incubated at 26 ± 2^oC for growth of the pathogen. The efficacy of various chemicals was observed by measuring radial

growth of the fungal colony in millimeters (mm). The inhibition evaluation was evaluated in terms of per cent inhibition of fungal growth was compared to the check. The efficacy of various fungicides was assessed by measuring the linear growth of the fungus. The per cent inhibition of mycelia growth was calculated by using the following formula:

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

Where,

PI = Percentage inhibition over control
C = Radial growth of the pathogen in control (mm)
T= Radial growth of the pathogen in treatment (mm)

Results and Discussion

Seven treatments were evaluated under *in vitro* against *Alternaria brassicae* by poison food technique in 0.05%, 0.1% and 0.2% concentration. Data of the results (Table-1 and Fig. 1) revealed that the 0.05% concentration of fungicides, the minimum growth was recorded in $T_{1=}$ Iprodione 25% + Carbendazim 25% (47.47mm) followed by $T_{5=}$ Propineb 70 WP (52.56mm), had significantly reduced the mycelia growth of tested pathogen by food poison technique than the control (90mm).

Table.1 *In vitro* effect of fungicides at different concentrations on radial mycelia growth and inhibition of *Alternaria brassicae*

Treatments	Mycelial growth in (mm)					
	Concentration 0.05 %		Concentration 0.1 %		Concentration 0.2 %	
	Radial growth (mm)	Inhibition (%)	Radial growth (mm)	Inhibition (%)	Radial growth (mm)	Inhibition (%)
$T_{1=}$ Iprodione 25% + Carbendazim 25%	47.47	47.25 (43.42)*	38.09	57.67 (49.36)	27.84	69.62 (56.20)
$T_{2=}$ Tebuconazole 250 EC + Trifloxystrobin WG 75	0.00	100.00 (90.00)	0.00	100.00 (90.00)	0.00	100.00 (90.00)
$T_{3=}$ Propiconazole 25 EC	0.00	100.00 (90.00)	0.00	100.00 (90.00)	0.00	100.00 (90.00)
$T_{4=}$ Difenoconazole 25 EC	0.00	100.00 (90.00)	0.00	100.00 (90.00)	0.00	100.00 (90.00)
$T_{5=}$ Propineb 70 WP	52.56	41.60 (40.16)	43.00	52.22 (46.27)	30.84	66.03 (54.17)
$T_{6=}$ Tebuconazole 250 EC	0.00	100.00 (90.00)	0.00	100.00 (90.00)	0.00	100.00 (90.00)
$T_{7=}$ Control	90.00	0.00 (0.00)	90.00	0.00 (0.00)	90.00	0.00 (0.00)
SEm±	**0.17**	**0.11**	**0.16**	**0.10**	**0.24**	**0.16**
CD at 5 %	**0.52**	**0.33**	**0.50**	**0.32**	**0.75**	**0.51**
C.V. (%)	**1.09**	**0.30**	**1.16**	**0.28**	**2.03**	**0.43**

*Figure in parenthesis are angular transformed value

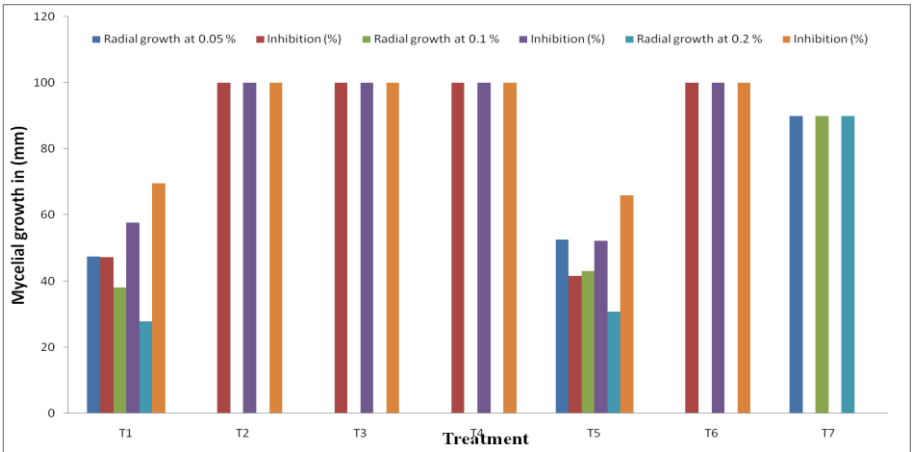

Fig. 1: *In vitro* **effect of fungicides at different concentrations on radial mycelia growth and inhibition of** *Alternaria brassicae*

In case of 0.1% concentration of fungicides the minimum growth was recorded in $T_{1=}$ Iprodione 25% + Carbendazim 25% (38.09mm) followed by $T_{5=}$ Propineb 70 WP (43.00mm), had significantly reduced the mycelia growth of tested pathogen by food poison technique than the control (90.00mm). In case of 0.2% concentration of fungicides the minimum growth was recorded in $T_{1=}$ Iprodione 25% + Carbendazim 25% (27.84mm) followed by $T_{5=}$ Propineb 70 WP (30.84mm), had significantly reduced the mycelia growth of tested pathogen by food poison technique than the control (90.00mm). Four treatments namely T_2 (Tebuconazole 250 EC + Trifloxystrobin WG 75), T_3 (Propiconazole 25 EC), T_4 (Difenoconazole 25 EC) and $T_{6\ =}$ (Tebuconazole 250 EC) were tested by poison food technique *in vitro* and result cent per cent restriction of radial growth of *Alternaria brassicae* in 0.05%, 0.1% and 0.2% concentration. Highest per cent inhibition of mycelial growth was recorded in $T_{1=}$ Iprodione 25% + Carbendazim 25% (47.25%) followed by $T_{5=}$ Propineb 70 WP (41.60%) at 0.05% concentration of fungicides. Results presented in Table-1 showed that highest per cent inhibition of mycelial growth was recorded in $T_{1=}$ Iprodione 25% + Carbendazim 25% (57.67%) followed by $T_{5=}$ Propineb 70 WP (52.22%) at 0.1% concentration of fungicides. Results presented in (Table-1) showed that highest per cent inhibition of mycelial growth was recorded in $T_{1=}$ Iprodione 25% + Carbendazim 25% (69.62%) followed by $T_{5=}$ Propineb 70 WP (66.03%) at 0.2% concentration of fungicides. Four treatments namely $T_{2=}$ Tebuconazole 250 EC + Trifloxystrobin WG 75, $T_{3=}$ Propiconazole 25 EC, $T_{4\ =}$ Difenoconazole 25 EC and $T_{6\ =}$ Tebuconazole 250 EC were highly effective for inhibiting the growth (100%) in 0.05%, 0.1% and 0.2% concentration. Meena *et al.*, (2004) and Biswas and Ghosh (2018) evaluated bio-control agent (*Trichoderma viride*) and fungicides (Mancozeb and Carbendazim) for controlling Alternaria blight in Indian mustard. Fungicide Mancozeb and Carbendazim caused 100% reduction in mycelia growth, while the bio-control agent significantly reduced disease severity. Khan *et al.,* (2007) and Singh *et al.,* (2008) tested efficacy of different fungicides (Apron 35 SD, Ridomil MZ 72 WP and Carbendazim 50%) and bioagent (*Trichoderma harzianum* and *Pseudomonas flurescence*) alone and in combination against Alternaria blight and found seed treatment with *Trichoderma harzianum* @ 10g/kg seed + 3 foliar sprays of same bioagent @ 10% was most effective in minimizing the disease intensity.

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