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SHORT COMMUNICATION

COMPARATIVE EFFICACY OF FUNGICIDES, *TRICHODERMA VIRIDE* AND NEEM IN THE MANAGEMENT OF WHITE RUST OF INDIAN MUSTARD

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Abstract: The reduction in productivity and quality of mustard are caused by numerous biotic and abiotic stresses. White rust disease is caused by an obligate biotrophic fungus *Albugo candida*, occurs wherever cruciferous crops are grown in the World and is responsible for considerable yield losses. To study the management of white rust few experiments were conducted at Guru Kashi University, Talwandi sabo (Punjab) under the laboratory conditions and for that different components namely; fungicides (Mancozeb, Ridomil and Carbendazim), biological control agent (BCA-*Trichoderma viride*) and botanical oil extract (*Azadirachta indica*) were used at different concentrations on sporangial germination of *Albugo candida* under two type of treatments (Pre Treatment & Treatment after disease infection). The research revealed that, all the fungicides and *Trichoderma viride* were performed better in pre-treatment than treatment after infection while Neem oil was effective post infection as compare to pre-treatment.

Keywords: *Albugo candida*, White Rust, Disease Management, *Trichoderma viride*

INTRODUCTION

India is one of the major producers of oilseed crops in the global oilseed market. Rapeseed-mustard is one of the seven edible oilseed crops grown in India, and it holds a unique place in the country's agricultural economy and social structure. Oilseed brassica crops are seriously threatened by an obligate biotrophic fungus called *Albugo candida*, which causes white rust/blister. White rust is one of the most destructive diseases of rapeseed-mustard in India leading to major yield losses up to 60 per cent (Meena *et al*., 2002), up to 85 per cent (Godika *et al*., 2001; Biswas *et al*., 2007), 36.88 per cent (Bal and Kumar, 2014) and 17-34 per cent (Yadava *et al*., 2014).

Meena and Jain (2002) reported that, the highest disease percent control was observed with Redomil MZ 100% and Neem extract (*Azadirachta indica*) 100% under laboratory conditions. Seed treatment with *T. viride* (1%) + foliar spray of copper oxychloride (0.25%) was found finest for management of white rust disease and increase the seed yield (Gopi *et al*., 2016).Considering these points, the present study was conducted to find out the most effective strategy of management against white rust and for that different component namely; fungicides (Mancozeb, Ridomil and Carbendazim), biological control agent (BCA-*Trichoderma viride*) and botanical oil extract (*Azadirachta indica*) were used at different concentrations on sporangial germination of *Albugo candida* under two type of treatments (Pre Treatment & Treatment after disease infection).

MATERIALS AND METHODS

Effect of fungicides, bio-control agent and botanical on sporangial germination of *A. candida*

The laboratory experiments were carried out at department of plant pathology in the Guru Kashi University, Talwandi Sabo, Bathinda (Punjab) during

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2019. In laboratory experiment, leaves were detached from the susceptible variety (Varuna) of *B. juncea* washed under running tap water followed by a wash with autoclaved water and then surface was wiped off with ethanol (70%). Under the technique of detached leaf inoculation, directly spores picking method was used. Twenty five times minute injury create on the healthy leaves of *B. juncea* with the sterilized blade and pick up the spores from infected leaves of white rust with the help of inoculating needle and spores are placed on injured portion of healthy leaves (inoculation of pathogen). Un-inoculated Control (treated with water) was also maintained. Detached leaves were kept in Petri dishes with moistened filter paper and placed in BOD incubator at 10°C and 70% relative humidity for the growth of sporangial germination (*A. candida)*. Wetness (moisture) of filter paper was maintained by spraying autoclaved distilled water. After 24 hours, observed germinated spores of A. candida then artificially treated detached leaves petri dishes removed from the BOD incubator and placed at ambient temperature. The numbers of germinated spores were counted on the detached leaves after 48 hours, while the control remains free from severe symptoms. Different components were used to check the antifungal activity, such as fungicides (Mancozeb, Ridomil, Carbendazim), BCA (*T. viride*) and botanical (Neem oil) at different concentrations (125, 250, 500 and 1000 ppm) on sporangial germination of *A. candida* under two type of treatments, 21 petri dishes were selected for pre treatment (20 for treatment and 1 for control) 4 petri dishes were selected for each treatment , one petri dishes for one concentration and control was same in all treatments. In treatment after disease infection management 21 petri dishes (20 for treatment and 1 for control) were also selected from 145 isolated petri dishes on the basis of nearly same percentage of sporangial germination to obtain better result.

PT -Pre Treatment (Before disease infection management / before sporangial germination).

TADI – Treatment after disease infection (Management of after sporangial germination).

Percent of sporangial germination and Percent of Inhibition in each treatment was calculated by using following formula:

Percent sporangial germination (%)

$$= \frac{\text{Number of sporangia inhibition}}{\text{Total number of sporangia}} \times 100$$

RESULTS AND DISCUSSION

Effect of fungicides, BCA and botanical on sporangial germination of *A. candida*

All the fungicides were significantly superior control. Mancozeb was significantly superior result in both; pre treatment overall mean (82%), Treatment after disease infection (TADI) overall mean of inhibition (49.32%) than other fungicides followed by ridomil result in pre treatment overall mean (77%), TADI overall mean of inhibition (48.13%) and carbendazim result in pre treatment overall mean(72%), TADI overall mean of inhibition (40.09%).

BCA- *T. viride* result in pre treatment overall mean (61%), TADI overall mean of inhibition (36.15%) and botanical (Neem oil) result in pre treatment overall mean (30%), TADI overall mean of inhibition (34.12%) were also evaluated. All chemicals and *T. viride* were found most effective in pre treatment than TADI while Neem oil was less effective in pre treatment. The effect of fungicides, bio-agent and botanical on sporangial germination of *A. candida* is summarized in Table 1, 2 and 3. The efficacy of fungicides, BCA (*T. viride*) and botanical (Neem extract) in the management of white rust of rapeseed-mustard was also reported by others workers (Meena and jain 2002; Singh and Singh 2005b; Yadav 2009 and Gopi *et al*., 2016).

Table 1. Effect of fungicides, bio-agent and botanical on sporangial germination of *A. candid*a in Pre Treatment

S. No.	Treatments	Pre Treatment of disease infection (% inhibition of sporangial germination)			
	Concentration (in ppm)	125	250	500	1000
1	Mancozeb 75% WP	64	72	92	100
2	Ridomil(Metalaxyl 4% + Mancozeb 64% WP)	60	64	84	100
3	Carbendazim 50% WP	52	64	76	96
4	*Trichoderma Viride* 1% WP	48	56	64	76
5	Neem oil (Azadirachtin 0.03%)	12	16	36	56

Table 2. Effect of fungicides, bio-agent and botanical on sporangial germination of *A. candid*a in Treatment after disease infection

S. No.	Treatments	Treatment After Disease Infection (% inhibition of sporangial germination)			
	Concentration (in ppm)	125	250	500	1000
1	Mancozeb 75% WP	16.67	30.28	50.33	100
2	Ridomil (Metalaxyl 4% + Mancozeb 64% WP)	17.22	24.30	51.02	100
3	Carbendazim 50% WP	15.14	19.68	49.54	76
4	*Trichoderma viride* 1% WP	13.10	18.62	42.10	70.8
5	Neem oil (Azadirachtin 0.03%)	12.79	17.69	41.01	65

Table 3. Effect of fungicides, bio-agent and botanical on sporangial germination of *A. candid*a in Pre Treatment of disease infection and Treatment After Disease Infection.

S.No.	Treatments	Pre Treatment of disease infection(% Overall mean inhibition of sporangial germination)	Treatment After Disease Infection Overall mean (% inhibition of sporangial germination)
1	Mancozeb 75% WP	82	49.32
2	Ridomil (Metalaxyl 4% + Mancozeb 64% WP)	77	48.13
3	Carbendazim 50% WP	72	40.09
4	*Trichoderma viride* 1% WP	61	36.15
5	Neemoil (Azadirachtin 0.03%)	30	34.12
SEm(±)		9.277	3.084
SDm (±)		20.744	6.895

CONCLUSION

Phytopathogenic fungus *A. candida* not only reduces the yield but also effect the quality of mustard crop. In the current research, we conducted the in-vitro experiments to observe the effect of fungicides (Mancozeb, Ridomil and Carbendazim), biological control agent (BCA-*Trichoderma viride*) and botanical oil extract (*Azadirachta indica*) against sporangial culture of *A.candida*. Our findings indicated that all the fungicides significantly control the growth of fungus specifically mancozeb proved to be the most effective fungicide in inhibition of fungus spores. In the form of eco-friendly approaches *T. viride* were found most effective in pre-treatment than treatment after disease infection while neem oil was less effective in pre-treatment. Hence, integrated plant disease management (IPDM) strategies are a finest way rather than using a single component strategy proved to be more effective and sustainable.

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