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COMPARATIVE EFFICACY OF FUNGICIDES, SELECTED BOTANICALS AND *TRICHODERMA VIRIDE* AGAINST EARLY BLIGHT (*ALTERNARIA BRASSICICOLA*) OF MUSTARD (*BRASSICA JUNCEA* L.)

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ABSTRACT
A field experiment was conducted at the research field of the Department of Plant Pathology, SHIATS, Allahabad, (UP) during the *rabi* season of 2013-14 by seed treatment and foliar sprays of fungicides, plant extracts and bioagent. the crop was grown by adopted good agronomic practices and data was recorded as per cent disease severity on leaves at 60, 75 and 90 days after sowing, and pods at 75, 90 and 105 days after sowing. Results revealed that the foliar spray of mancozeb @ 2.5 g/L significantly reduced the Alternaria blight and increased yield (14.17 q/ha), highest benefit cost ratio (1:2.98 %) followed by *Trichoderma viride* (seed tretment @10 g/kg and foliar spray @ 10 g/L), Bavistin 50 WP (seed treatment @ 2 g/kg and foliar spray @ 2g/L), Propicanazole (seed treatment @ 1 % and foliar spray @ 1 %), Iprodine + carbendazim (Foliar spray @ 2%), *Allium sativam* (foliar spray @ 1% w/v) and *Azadirachta indica* (foliar spray @ 1% w/v).

INTRODUCTION

Indian mustard [*Brassica juncia* (L). Czern and Cross] is the principle rabi oilseed crop in India which covers 22% area and contributes 25% of production of total oil seed crops. Alternaria leaf blight (ALB) caused by *Alternaria brassicae* and *Alternaria brassicicola* has been reported from all the continents of the world and caused upto 10-70% yield loss (Kumar, 1997). The estimated area, production and productivity during 2011-12 of rapeseed- mustard in the world were 33.1 m ha, 60.7 million tons (mt) and 1832 kg/ha, respectively (Agriculture Statistics Division, GOI, 2012). Globally, Indian accounts for 20.2 percent and 10.7 percent of the total acreage and production (USDA, 2012). The average yield of rapeseed-mustard 2011-12 was 1145 kg/ha as compared to 1135 kg/ha of total oilseed (Agricultural Statistics Division, GOI, 2012). Indian mustard is convenient as monoculture because one crop is easier to plant, harvest, and market than mixture of other crop with low water requirement (Jha *et al.,* 2013). Different chemicals including systemic fungicides shave been used for management of this disease (Chattapadhyay and Bhunia, 2003). However increase environmental pollution and present day public perception on pesticide contaminants of foods specially the edible oils, development of alternate economical and ecofriendly approaches for disease management is needed several plant products are known to have antifungal activities which are environmentally safe and non phytotoxic also (Bisht and Khulbe 1995; Meena *et al.,* 2004). The damage in these chemicals was brought an awareness to find out other alternatives like eco-friendly management with the framework of IDM without affecting our precious eco-system (Mukhopadhyay, 1994) Currently studies pertaining to the use of botanicals in management of pathogens and related diseases are highly focused (Koche, 2013; Toppo, 2013; Mathad, 2013; Mahapatra, 2013; Bisht, 2013).

The concept of integrated disease management seeks to minimize the advantages in the use of fungicide. Microclimate of the crop canopy also contributes in increasing disease severity. It is observed that disease severity increases with increase in leaf wetness duration at all temperatures. (Jambhulkar *et al.,* 2012). The maximum observed mean disease severity occurred after 24h duration of wetness at 18ºC (Evans et al., 1992). So, the present study was conducted to generate information on effect of the aqueous extract of different botanicals (leaves of neem, bulbs of garlic and rhizomes of ginger) and their effective doses against this destructive disease of mustard.

MATERIALS AND METHODS

The experiment was carried out in the research plot of the Department of Plant Pathology, central research field, Sam Higginbottom Institute of Agriculture Technology and Sciences, during the *Rabi* season of 2013-2014. The crop was shown on 15th November in randomized block design

Table 1: Effect of different treatment on per cent disease intensity on leaf and pod of Indian mustard at different intervals

S.N.	Treatments detail	Disease intensity of leaves			Disease intensity of pods			Yield q/ha	Benefit Cost ratio in (%)
		60DAS	75DAS	90DAS	75DAS	90DAS	105DAS		
T_1	*Trichoderma viride* (ST) + (FS)	27.81	43.57	56.00	26.46	34.35	37.33	11.37	1:2.42
T_2	Bavistin (ST) + (FS)	26.98	42.45	55.99	26.36	33.49	36.88	12.08	1:2.42
T_3	*Azadirachtaindica* (FS)	30.08	45.34	57.90	28.33	36.10	39.29	9.56	1:2.04
T_4	*Allium sativum* (FS)	28.59	44.81	56.74	27.97	35.17	38.16	10.56	1:2.29
T_5	Propicanazole(ST) + (FS)	25.96	41.80	54.05	25.70	32.09	35.66	12.56	1:2.52
T_6	Iprodine + carbandazim (FS)	24.04	40.92	53.81	23.36	30.56	33.80	13.65	1:2.71
T_7	Mancozeb (FS)	23.11	39.83	51.87	21.23	26.46	30.81	14.17	1:2.98
T_0	Control	33.49	48.74	61.51	31.42	40.33	47.58	8.83	2.05
	S. Ed. (±)	2.02	1.28	1.71	2.10	1.86	2.97	0.39	-
	C. D. (P = 0.05)	4.33	2.74	3.66	4.50	3.99	6.37	0.85	-

[SD- seed treatment, FS- foliar spray]

with three replications and a uniform plant population with 45 cm x15 cm was maintained. Two botanicals, Neem oil (1 %), garlic bulb extract (1%), one bio agent *Trichoderma viride* 1 %, and two fungicides mancozeb 75 % WP (0.25 %), and carbendazim @ 50 WP (0.2 %) along with control treatments were selected and all were sprayed separately with their respective doses at 50, 65 & 80 days after sowing later initiation of disease. Observations on per cent disease intensity of leaf (60, 75 and 90 DAS) and per cent disease intensity of pod (75, 90 and 105 DAS), at an interval of 15 days. The per cent disease intensity was assessed as no. of leaves and pods infected / 5 plants randomly. Per cent Alternaria blight intensity was recorded on leaves and pods at 15 days interval following 0-9 disease rating scale (Singh, 2004), where, 0 = no visible symptoms,1 = 1 %, 3 = 2-10 %, 5 = 11-25 %, 7 = 26-50 % and 9 = > 51 % leaf area infected. Per cent disease intensity was calculated as Mc Kinney's (1923) formula. The formula used was as follows:

$$\text{Percent Disease Intensity} = \frac{\text{Sum of all individual rating X } 100}{\text{Total number of leaves observed x maximum rating}}$$

RESULTS AND DISCUSSION

The results revealed that spraying of botanicals [neem oil @ 1 %, and garlic bulb extract @ 1 %], bioagents [*Trichoderma viride* @ 1 % (seed treatment) + *T. viride* @ 1 % (foliar spray) and fungicides [mancozeb 75 % WP (0.25 %), carbendazim @ 1%, Iprodine @ 1% + carbendazim 2gm/l, Propicanazole @ 1% (seed treatment) + Propicanazole 1% (foliar spray), Bavistin @ 2g/kg (seed treatment) + Bavistin @ 2g/l (foliar spray)] in their respective dose reduced the leaf blight disease and subsequently increased the yield and yield attributes in comparison to untreated control (check).

The result showed that all the botanicals, bioagent and fungicides reduced the per cent leaf/ pod infection reduced significantly in comparison to untreated control. Minimum per cent of leaf infection was noticed in mancozeb 75 % WP. Sprayed plots @ 0.25 % was found to be most effective in reducing the per cent disease intensity on leaves (21.8,36.76 and 53.07 %) at 60, 75 and 90 DAS (Table 1) and on pods (12.88, 20.53 and 24.56 %) at 75, 90 and 105 DAS (Table 1). Followed by garlic bulb extract @ 1 %, neem oil @ 1 %, *Trichoderma viride* @ 1 %, carbendazim @ 0.2 %, propicanazole @ 1%, Iprodine @1% + carbendazim @ 1% and Bavistin @ 2g/L. Thus mancozeb @ 0.25 % showed superior result and provided the least result in all the treated plots.

Seed yield (kg/ha) of mustard was increased due to application of different fungicides, bioagent and botanicals. The rate of increment of seed yield (kg/ ha) was different in different treatments. The result showed that maximum seed yield (kg/ ha) was harvested on mancozeb sprayed plots @ 0.25 % a.i. (14.17 q /ha) followed by garlic bulb extract @ 1 % (10.56 q/ ha), which was similar to that of neem leaf extract @ 1 % (9.56 q/ ha) and *Trichoderma viride* @ 1 % (11.37 q/ ha) their differences were statistically at par with mancozeb.

Among the seven treatments, spraying of mancozeb @ 0.25 % followed by garlic bulb extract @ 1 % caused minimum disease intensity on leaves, siliqua and increased the yield and yield attributes of mustard. These results also proved that the application of garlic bulb extract could be used as a substitute for chemical fungicides, mancozeb and others in the management of Alternaria leaf blight of mustard. Although, mancozeb proved to the best in increasing seed yield and the plant extracts also significantly increased the yield as compared to untreated control. Here, garlic bulb extract found to be more effective followed by neem leaf extract and others. Prasad and Kumar (2007) reported that spraying of garlic bulb extract gave significantly better crop yield and oil content in comparison to chemical fungitoxicants like mancozeb, thiram and sulphur dust, which are frequently used for the management of important diseases. This result contradicts with the result of Prasad and Lallu (2006) that mancozeb provided the highest disease reduction and apart from mancozeb, *Datura strumarium* found to be most effective in increasing seed yield. Whereas, Meena *et al*., (2004) confirmed the above experiment that aqueous bulb extract of garlic caused significant disease reduction of mustard. This experiment, therefore, suggests that garlic bulb extract @ 5% may be used as a substitute for chemical fungicide for ecofriendly management of Alternaria leaf blight of mustard.

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