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Efficacy of botanicals and chemical fungicide on development of *Alternaria* blight of mustard (*Brassica juncea*) and their economics

POONAM MANJHI, D.S.TOMAR AND M.K.NAYAK

JNKVV, College of Agriculture, Tikamgarh (M.P.) 472001

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ABSTRACT

In vitro studies and field experiment were conducted at JNKVV, college of Agriculture, Tikamgarh during Rabi season of 2015-16. Six botanicals viz, neem leaf (10%), datura leaf (10%),eucalyptus leaf (10%) Aak leaf (10%), jetropha leaf (10%), in the form of crude extract, neem seed kernel extract (10%)and one chemical fungicide mancozeb (0.25%) were evaluated against Alternaria brassicae under lab and field conditions. In the laboratory, among the seven treatments, Mancozeb was found to be the best fungicide as compared to botanicals in reducing the radial growth of Alternaria brassicae. In field, all the botanicals and fungicide treatments under study were significantly effective in controlling the disease intensity of Alternaria blight over control. The minimum per cent disease intensity (14.58%) was recorded for Mancozeb followed by botanical neem seed kernel extract (19.86%). The highest seed yield was recorded for chemical fungicide mancozeb (1225.27 kg ha^{-1}), which was significantly superior over all other treatments recording 85.74 per cent increase in seed yield over control. The highest incremental economic benefit (Rs 17105.7 ha^{-1}) was achieved with spraying of mancozeb followed by neem seed kernel extract (Rs16756 ha^{-1}). But maximum benefit cost ratio 7.24 recorded for eucalyptus leaf extract (Eucalyptus globulus) followed by neem leaf extract (Azadirachta indica) (6.36).

Keywords: Botanicals, fungicide, control, Alternaria blight, disease intensity, mustard

INTRODUCTION

Mustard (*Brassica juncea*) is the second most important oil seed crop in India after soybean. It accounts for nearly 20-22% of the total oilseeds production in the country. Mustard seed is grown with a different consumption pattern in the country. Indian mustard is mainly used for extraction of mustard oil while black mustard is mainly used as a spice. India is the fourth producer of mustard contributing to around 11 % of world's production (Kumrawat and Yadav, 2018). Mustard is predominantly cultivated in Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and Gujarat. Among these states, Rajasthan, Uttar Pradesh and Madhya Pradesh are the major rapeseed-mustard growing states and cover the 70 per cent of the total national acreage and contribution around 72 per cent of production (Chauhan *et al.*, 2011).In Madhya Pradesh, mustard crops are cultivated in area about 6.17 million hectares with the production of about 6.66 million tonnes and productivity of about 1079 kg ha^{-1}. In Tikamgarh district mustard crops are cultivated in area about 0.90 million hectares with production of 0.60 million tonnes and productivity of about 705 kg ha^{-1} (Anonymous, 2016). The losses in oilseed crop due to biotic stresses are about 49.9%, out of which diseases causes severe yield reduction at different growth stages. Alternaria blight and white rust are two major diseases severely affecting Indian mustard crop during cool and humid weather causing 47% losses in yield (Singh *et al.,* 2009). Alternaria blight of mustard caused by *Alternaria brassicae* (Berk) Sacc. Is assuming importance as it has started becoming severe and resulting in heavy losses particularly during favorable weather condition. The disease attacks all areal parts of the plants including pods resulting in severe defoliation and blighted appearance of the plant (Tomar and Atar, 2017). Hence the present investigation explored the possibilities to identify a suitable botanical and chemical fungicide for managing the disease.

MATERIAL AND METHODS

The botanicals viz, neem leaf (10%), datura leaf (10%), **e**ucalyptus leaf (10%) Aak leaf (10%), jetropha leaf (10%), in the form of crude extract, neem seed kernel extract (10%)and one chemical fungicide mancozeb (0.25%)

Corresponding author email: tomar_sd@rediffmail.com

were evaluated against Alternaria blight by adopting poisoned food technique.Fresh plant extracts was prepared by grinding the required quantity of leaves (100g). Before grinding equal quantity of water was added in the respective plant parts (1:1 weight/ volume basis). The crude extracts of different leaves were sieved through muslin cloth. The filtered extracts were used @ 10 per cent by adopting poisoned food technique. The plant extract and fungicide were aseptically melted in Potato Dextrose Agar medium in appropriate proportions. Twenty ml of the medium is poured in each 9 cm diameter Petri dishes and solidified. One disc (7mm) of the medium containing fungal culture of the pathogen was cut from the 7 days old culture and was transferred in the centre of the Petri dish under aseptic condition. The inoculated plates were incubated at 25^0C and growth of the pathogen measured after 7 days. The medium without plant extract and fungicide was used as control.

Field evaluation:A field experiment was conducted during *rabi*season of 2015-16 at College of Agriculture, Tikamgarh under natural field condition. The variety Pusa Bold was sown in randomized block design with 8 treatments including check (untreated control). The plot size was 4x3 m^2 and replicated thrice for each treatment. Recommended agronomic practices were followed to raise the crop. Six botanicals and one fungicide namely leaves of Neem (*Azadirachta indica*) @10%, Datura (*Datura stramonium*) @10%, Eucalyptus (*Eucalyptus globulus*) @10%, Aak (*Calotropis procera*), Jatropha (*Jatropha curcus*) @10%, Neem seed kernel extract @ 5% and one fungicide Mancozeb @ 0.25% each botanicals and fungicide were sprayed starting from initial appearance of disease and second spray was done after 15 days of first spray. One check (untreated control) was also maintained receiving water spray. The final intensity of the disease was recorded 15 days after the second spray. The intensity of the disease was calculated by following 0-5 scale (Conn *et al.*, 1990) on randomly selected plants. The grain yield per plot was also recorded which was extrapolated to give the value of yield in kg ha^{-1}. The data were statistically analyzed.

RESULTS AND DISCUSSION

In *Vitro* evaluation of Botanicals and fungicide

The mean radial growth in different botanicals and fungicide varied from 17.50 mm to 66.00 mm against 87.25 mm in control (Table 1). The minimum mean radial growth was recorded in Mancozeb (17.50 mm) followed by Neem seed kernel extract (35.25 mm), eucalyptus leaf extract (52.5 mm), neem leaf extract (64.5 mm), datura leaf extract (65.5mm), jatropha leaf extract (66.00) and aak leaf extract (67.25mm). The mean redial growth in all the treatments was significantly less as compared to control (87.25 mm).The data on the overall mean inhibition by different botanicals and fungicide over control indicate that maximum reduction was recorded for Mancozeb (79.94 %) followed by neem seed kernel extract (59.6 %), eucalyptus leaf extract (39.83 %), neem leaf extract (26.07 %), datura leaf extract (24.93), jatropha leaf extract (24.36%) and aak leaf extract (22.92 %). All the tested botanicals significantly inhibited the fungal growth in the tested form. The minimum mean radial growth was recorded in Mancozeb followed by Neem seed kernel extract (Achook) and eucalyptus leaf extract. Singh *et al.*, (2013) observed that the extracts of *Azadirachta* leaf inhibited the mycelial growth of *Alternaria brassicae.* Ganie *et al.*, (2013) screened the efficacy of extracts of five plants viz. Azadirachta indica, Lantana camara, Ocimum sanctum, Eucalyptus globulus and Calotropis gigantea A. brassicae under vitro conditions and found that all five plant extracts at all four concentrations significantly inhibited the mycelial growth *A. brassicae* as compared to control. Yadav *et al.*, (2018) evaluated the some fungicides, biocontrol agents and plant extracts against *Alternaria solani* in laboratory and reported minimum radial growth (3.00mm) at 3000 ppm concentration of hexaconazole.

Table1: Effect of different botanicals and fungicide on radial growth (mm) of *Alternaria brassicae*after 7 days of incubation

Treatments	Radial growth (mm)	% Inhibition over control
Neem leaf extracts	64.5*	26.07
Datura leaf extracts	65.5	24.93
Eucalyptus leaf extracts	52.5	39.83
Aak leaf extracts	67.25	22.92
Jatropha leaf extracts	66.00	24.36
Neem seed kernel extracts	35.25	59.60
Mancozeb	17.50	79.94
Control	87.25	
C.V.	7.20	
SEm±	2.05	
CD (P=0.05)	6.02	

**Mean of four replications*

Field evaluation of botanicals and fungicide

The results (Table 2) reveal that all the tested six botanicals and one fungicide were significantly effective in controlling the intensity of *Alternaria* blight over control. The minimum disease intensity per cent was recorded for mancozeb (14.58%) followed by neem seed kernel extract (19.86%), while maximum disease intensity was recorded in control plot (39.67%). The highest per cent disease control was exhibited by mancozeb (63.25%) followed by neem seed kernel extract (49.94%), eucalyptus leaf extract (45.10%), neem leaf extract (41.42%), datura leaf extract (32.80%), jatropha leaf extract (25.54%), and aak leaf extract (17.47%).

Table 2: Efficacy of different botanicals and fungicide on disease intensity and yield of mustard against Alternaria brassicae

Treatments	PDI	% Decrease over control	Yield (kg ha^{-1})	% increase in yield over control	% Yield loss
Neem leaf extracts	23.24* (28.78)**	41.42	1027.74	55.80	16.12
Datura leaf extracts	26.66 (31.08)	32.80	986.05	49.48	19.52
Eucalyptus leaf extracts	21.78 (27.77)	45.10	1071.46	62.43	12.55
Aak leaf extracts	32.74 (34.90)	17.47	744.32	12.83	39.25
Jatropha leaf extracts	29.59 (32.94)	25.54	906.44	37.41	26.02
Neem seed kernel extracts	19.86 (26.44)	49.94	1196.66	81.41	2.33
Mancozeb	14.58 (22.45)	63.25	1225.27	85.74	0
Control	39.67 (39.06)	0	659.66	0	46.16
C.V.	13.12		14.32		
SEm±	1.97		80.81		
CD (P=0.05)	5.73		235.18		

*PDI = Per cent Disease Intensity, * Mean of three replications, ** Figures in parenthesis are transformed (Angular) Value*

All the treatments independently gave significantly higher seed yield as compared to control except Aak leaf extract. The mancozeb treatment was most effective and gave higher seed yield over all treatments. The highest seed yield was recorded for mancozeb (1225.27 kg/ha) followed by neem seed kernel extract (1196.66 kg ha^{-1}) and least in control (659.66 kg ha^{-1}). The mancozeb, recorded maximum increase in yield (85.74%) followed by neem seed kernel extract (81.41%) over control.

All the tested botanicals and fungicide were found significantly effective in controlling the disease intensity of Alternaria blight over control (Singh *et al.*, 2013). Ahmad and Ansari (2016) evaluated six plant extract, six bio agents and six fungicides against Alternaria leaf spot of *Brassica campestris,* and indicated thatall the plant extracts, bio-agents and fungicides was effective to reduce the disease *in vitro* and *in vivo* conditions but fungicides gave maximum reduction of the disease. Kumar and Rathi (2018) observed that foliar spray with mancozeb (0.2%) at 45 DAS followed by hexaconazole (0.05%) at 60 DAS was found most effective in controlling Alternaria leaf blight of Indian mustard severity up to 78.0% and Alternaria pod blight severity up to 56.5% and increased seed yield up to 29.9% as compared to untreated control. Mohan *et al.*, (2017) also reported that two sprays of mancozeb (0.2%) at 47 and 107 DAS followed by one spray of sulfex (0.2%) at 131 DAS, gave maximum disease control of Alternaria blight of Indian mustard.

Economics

Data (Table 3) revealed that the maximum net profit was recorded in T_7 mancozeb (Rs 17105.7 ha^{-1}), followed by T_6 neem seed kernel extract (Rs16756 ha^{-1}). On the basis of benefit cost ratio T_3 eucalyptus leaf extract (*Eucalyptus globulus*) was most economical (7.24) followed by T_1 neem leaf extract (*Azadirachta indica*) (6.36). Gaur *et al.*, (2012) also observed highest incremental economic benefit with fungicide (Bavistin) @ 2 g/kg.

Table 3: Economics of different treatments

Treatments	Doses /ha	Grain yield (kg ha^{-1})	Additional Yield Over Control	Additional profit (Rs ha^{-1})	Cost of treatments (Rs ha^{-1})	Net profit (Rsha^{-1})	B.C. Ratio
T_1Neem leaf extract (*Azadirachta india*)	5.0 lit	1027.7	368.0	13987.0	1900	12087.0	6.36
T_2Datura leaf extract (*Datura stramonium*)	5.0 lit	986.0	326.3	12402.8	1900	10502.8	5.53
T_3Eucalyptus leaf extract(*Eucalyptus globulus*)	5.0 lit	1071.4	411.8	15648.4	1900	13748.4	7.24
T_4Aak leaf extract (*Calotropis procera*)	5.0 lit	744.3	84.6	3217.0	1900	1317.0	0.69
T_5Jetropha leaf extract (*Jatropha curcas*)	5.0 lit	906.4	246.7	9377.6	1900	7477.6	3.93
T_6Neem seed kernel extract	2.5 lit	1196.6	537.0	20406.0	3650	16756.0	4.59
T_7Mancozeb	2.5 kg	1225.6	565.9	21505.7	4400	17105.7	3.89
T_8 Untreated plots	-	659.6					

Note: Price of mustard @ Rs 38/kg , Labours charges @ Rs 900 for 2 spray, Labours charges for preparation of crude extract of botanicals and cost of fungicide:, Neem leaf extract (Azadirachta indica) Rs. 100/lit., Datura leaf extract (Datura stramonium) Rs. 100/lit., Eucalyptus leaf extract (Eucalyptus globulus), Rs. 100/lit., Aak leaf extract (Calotropis procera) Rs. 100/lit., Jetropha leaf extract (Jatropha curcas) Rs. 100/lit., Neem seed kernel extract Rs. 550/lit and Mancozeb 700/kg.

REFERENCES

Anonymous (2016) Area, production and productivity of mustard.www.mpkrishi.org.

Ahmad, Aqeel and Ansari, Yaseen (2016) In Vitro and In Vivo management of alternaria leaf spot of Brassica campestris L. *Journal of Plant Pathology and Microbiology.***7** (7): 02-06

Chouhan, J.S.; Singh, K.H.; Singh, V.V. and Kumar, Satyanshu. (2011) Hundred years of rapessed- mustard breeding in India: Accomplishments and future strategies. Indian *Journal of Agriculture Science***81**(12): 1093-1109.

Ganie, S. A., Pant, V. R., Ghani , M. Y. , Hussain Lone, Ashiq, Anjum , Qaisar and Razv, S. M. (2013) In vitro evaluation of plant extracts against Alternaria brassicae (Berk.) Sacc. causing leaf spot of mustard and Fusarium oxysporum f. sp. lycopersici causing wilt of tomato. *Scientific Research and Essays*. **8** (37): 1808-1811.

Gaur, R.B., Sharma, R.N. and Chattopadhyay, C. (2012) Integrated disease management in rapeseed mustard using bioagents, plant products and fungitoxicants.*Indian Journal of Plant Protection***40**: 175-181

Kumar, Akesh Anil and Rathi ,A.S. **(**2018) Management of Alternaria blight in Indian mustard through fungicides under field conditions. *International Journal of Chemical Studies***6** (2): 2042-2044.

Kumrawat, Meena and Yadav, Manju (2018) Trends in area, production, and yield of mustard crop in Bharatpur region of Rajasthan. *International Journal of Engineering Development and Research***6** (1): 315-321.

Mohan, Man, Mehta, Naresh and Avtar, Ram. (2017) Integrated management of foliar diseases of Indian mustard. Forage Res.,**42** (4): 274-278.

Singh, Narendra, Sriwastava, A.K. and Udit Narain (2009) Status of *Alternaria* leaf spot of brassicae in Uttar Pradesh and role of climatic factors in the development of the disease. *International Journal of Plant Science***3** (1): 37-39.

Singh, Surendra, Godara, S.L. and Gangopandyay (2013) Studies on antifungal properties of plant extracts on mustard blight caused by Alternaria brassicae. Indian Phytopath **66** (2): 172-176.

Tomar, D. S. and Singh, Atar (2017) Effect of date of sowing on intensity of Alternaria blight and seed yield of mustard. Symposium on challenge and opportunities: Management of plant diseases under weather change, at JNKVV, Jabalpur, December, 14-15, 2017. P 18.

Yadav Vikash Kumar, Kumar, Vijay and Mani, Arghya (2018) Evaluation of fungicides, biocontrol agents and plant extracts against early blight of potato caused by *Alternaria solani*. *International Journal of Chemical Studies***6**(1): 1227-1230.