International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(5): 2878-2881

Received: 17-07-2020
Accepted: 23-08-2020

Gaurav Kumar Yadav
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Dharmendra Kumar
Department of Plant Pathology, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Neelam Maurya
Department of Plant Pathology, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh, India

Corresponding Author:
Dharmendra Kumar
Department of Plant Pathology, Banda University of Agriculture & Technology, Banda, Uttar Pradesh, India

Assessment of disease suppressing ability of some fungicides and neem oil for management of Alternaria blight of linseed (*Linum usitatissimum* L.)

Gaurav Kumar Yadav, Dharmendra Kumar and Neelam Maurya

DOI: https://doi.org/10.22271/chemi.2020.v8.i6ao.11642

Abstract
Alternaria lini and *Alternaria linicola* is known to cause destruction of host tissue through the reduction of photosynthetic potential by inciting spots and blights of the crops including linseed (*Linum usitatissimum* L.) Altrnaria blight of Linseed also reduces the oil content and quality of fiber of linseed. The present investigation was aimed to evaluate the efficacy of various fungicides and neem oil for management of this important disease. Three sprays of fungicides namely carbendazim 0.2%, mancozeb @ 0.2%, hexaconazole @ 0.1%, propiconazole @ 0.1%, tubaconazole 0.1%, kresoxin- methyl 0.1% and trichyclazole+mancozeb 0.1% and neem oil was done after the first appearance of the symptoms of Alternaria leaf blight**.** Minimum disease severity with maximum seed yield was recorded with three sprays of Mancozeb @ 0.2% followed by Propiconazole @ 0.1% and Hexaconazole @ 0.1%, respectively. Maximum seed yield (1443.75 kg./ha) was obtained with the spraying of Mancozeb @ 0.2% followed by Hexaconazole @ 0.1%. Good control was also obtained by the spray of carbendazim @ 0.2%, propiconazole @ 0.1% and hexaconazole @ 0.1%. Neem oil and @ 2% was found good for control of Altenaria blight pathogens and these could be used as substitute of chemical fungicides for ecofriendly management of Alternaria leaf spot.

Keywords: Alternaria, disease, fungicide, linseed, *Alternaria lini*, *Alternaria linicola*

Introduction
Linseed (*Linum usitatissimum*) also known as flax is one of the oldest cultivated oilseed crop in the world. This is an important crop grown in temperate climatic areas for production of either fiber (fiber linseed) or oil (oilseed linseed). The oil of linseed seed is enriched in α-linolenic acid (ALA). Linseed oil readily polymerizes on exposure to oxygen that make it useful for a variety of industrial products like including varnish and linoleum, while meal from pressed seed is useful as animal feed. In addition to industrial applications, ω-3-enriched linseed oil is gaining importance in livestock feed and aqua-feed applications. Linseed oil is also recognized as a good source of ALA for the human diet. Additional flax constituents, including fiber and lignans (Czemplik and Szopa, 2009; Vaisey-Genser and Morris, 2003) [16] is good for human health. Linseed seed contains 33-47% oil, 5.5% Linolenic acid, 20.3% Protein, 38% Fat, 29% Carbohydrate, 4.8% Fiber, 2.4% Ash in different varieties. Its oil cake is good in taste and feed for milch cattle and poultry and hence priced 50% higher than rapeseed and mustard cake. Linseed is listed for medicinal use in Indian pharmacopeia. It is used as a demulcent, emollient, expectorant, diuretic astringent after roasting and in the form of poultice for the relief local inflammations and ulcer, boils the carbuncle

Diseases are one of the major hurdles that limit the productivity of Linseed. *Alternaria linicola* (Groves and Skolko, 1944) and *Alternaria lini* Dey inciting Alternaria blight in linseed are commonly occurring pathogens in India. The pathogens are responsible for a range of symptoms on its host including leaf spots and necrotic lesions on the capsules, which can result in a loss in yield and a reduction in oil quality. Alternaria blight of linseed has assumed greater importance in different parts of country, especially mid-eastern India. In the last few years, *A. linicola* infection has been the main reason for the failure of the linseed seed. The disease cause up to 60 per cent annual yield loss depending upon the severity of the disease

(Chauhan and Srivastava, 1975; Singh *et al.*, 2003; Singh and Singh 2004a) [2, 7, 11]. Since till date no resistant variety is available and search on newer fungicides are imperative. The chemical control is an economic means of management of the disease. Hence, it is necessary to check the potential of fungicides to manage the disease in present scenario of increasing genetic variations in population of pathogens. The aim of the present investigation was to evaluate the various fungicides against the Alternaria blight of linseed.

Materials and Methods

Efficacy test of foliar sprays of fungicides on Alternaria blight of linseed

Seven chemical fungicides namely Propiconazole 0.1%, Hexaconazole 0.1%, Kresoxim-methyl 0.1%, Tebuconazole 0.1%, Mancozeb 0.2%, Tricyclazole + Mencozeb 0.1% Carbendazim 0.2% and one non chemical fungicides neem oil 0.2% were evaluated for their efficacy test against Alternaria leaf blight of linseed. Linseed variety Shekhar was sown on 22nd November, 2016 at 10 × 25 cm spacing 27 plots of 3 × 2 m were sown and seed rate used was 6 kg/ha. The extra plants were thinned out 15 days after sowing to maintain optimum plant population. Two irrigation were given, one at time of first flowering followed by another at fruiting stage. The fertilizer added was 120; 60: 60 (N P K). The crop were inoculated with aggressive strain of *Alternaria lini* and *Alternaria linicola* to create the artificial disease for evaluation of the efficacy of fungicides. 7 fungicides were sprayed thrice after the appearance of the Altrnaria leaf blight in different concentration namely Propiconazole 0.1%, Hexaconazole 0.1%, Kresoxim-methyl 0.1%, Tebuconazole 0.1%, Mancozeb 0.2%, Tricyclazole + Mencozeb 0.1% and Carbendazim 0.2% for evaluation of their disease suppressing ability against Alternaria leaf blight. Observations for per cent disease severity (PDS) were recorded on 12 days intervals after every one spray until harvest from 5 tagged plants chosen randomly in each randomly each plot of the crop on leaves following scale of (Conn *et al*. 1990). Observations of symptoms were noted on lower, middle, and upper leaves of randomly selected five plants from each genotype and in each replication. The structures of the pathogens associated with the disease were also observed under the microscope for authentication of the Alternaria blight disease. The per cent disease intensity (PDI) was calculated by employing formula (Wheeler, 1969) mentioned below:

$$\text{PDI} = \frac{Sum\ of\ total\ numerical\ ratings}{Total\ number\ of\ leaves\ observed}\ X\ \frac{100}{\text{Highest grade}}$$

Seed yield was recorded in each genotype separately to determine the differences in yield between each genotype and yield kg/ha was calculated.

Estimation of marketable and total yield

At maturity the crops were harvested. On the basis of per plot yield, total yield q/ha was calculated. Percent increase in yield was calculated by following formula.

Avoidable yield loss

It can be calculated by following formula.

$$\text{Avoidable yield loss} = \frac{Y_p - Y_{up}}{Y_p} \times 100$$

Where,
Y_p = Yield under protected condition
Y_{up} = Yield under unprotected condition

Statistical analysis

Statistical analysis of the data was done using micro 32 unit system of the experiment (two factors RBD). Critical differences (CD) were calculated at 5% level of significance for comparison of treatment and correlation coefficients were calculated at 5% and 1% level of significance.

Result and Discussion

The experiment was conducted at Student's Instructional Farm during 2016-17 by using cultivar Shekhar. Seven fungicides namely carbendazim 0.2%, mancozeb @ 0.2%, hexaconazole @ 0.1%, propiconazole @ 0.1%, tubaconazole 0.1%, Kresoxin- methyl 0.1% and Trichyclazole+mancozeb 0.1%. Neem oil @ 2% was sprayed as non chemical fungicide. The disease symptoms characterized by formation of spots on leaves, stems and pods were noted observed with various intensity in the experiments (Fig.1). The conidia of *Alternaria linicola* and *Alternaria lini* were also found associated with the infected leaves and pods (Fig.2 and Fig.3). Spray of all fungicides and neem oil reduced the blight severity of alternaria blight in linseed and increased the yields in comparison to the untreated control (water spray). Of the 7 fungicides sprayed, manzozeb was found most effective (Table 1, Line figure 1) for reduction of disease severity in comparison to control (42.32%) followed by propiconazole (40.36%), hexaconazole (38.31%), carbendazim (36.69%), kresoxin- methyl (35.21%), tubaconazole (31.58%) and trichyclazole+mancozeb (19.20%). Spray of neem oil reduced the disease severity by 27.65% in comparison water sprayed control (58.13%). Maximum seed yield was recorded in three spray of mancozeb @ 0.2 per cent (Table-2) followed by Propiconazole, Hexaconazole, Carbendazim, Kresoxin-methyl, tubaconazole, neem oil and Trichyclazole+mancozeb. Effect of spray of chemicals and neem cake was also found positive on test weight (1000 seed weight) of linseed (Table-2).

The test weight (1000 seed weight in g) ranges from 3.98 to 5.09. The maximum test weight was recorded in fungicide spray with Mancozeb @ 0.02% (5.090) followed by Propiconazole @ 0.1%% (4.83), Hexaconazole @ 0.1% (4.73), Carbendazim @ 0.2% (4.62), Kresoxim-methyl @ 0.1% (4.48), Tubaconazole @ 0.1% (4.35), Neem oil @ 2% (4.32) and Tricyclazole + Mancozeb @ 0.1% (4.28). The test weight in the with water spray control plots was 3.98 g. (Table-2).

Avoidable yield loss of spray of fungicides and neem oil treatments ranges from 8.34-26.19. The highest yield loss was avoided with fungicidal spray of Mancozeb @ 0.02% (26.19) followed by Propiconazole @ 0.1%% (22.85), Hexaconazole @ 0.1% (20.14), Carbendazim @ 0.2% (16.22), Kresoxim-methyl @ 0.1% (13.67), Tubaconazole @ 0.1% (12.79), Neem oil @ 2% (11.89) and Tricyclazole + Mancozeb @ 0.1% (8.34) (Table-2).

It is evident from the results that all treatments significantly reduced the disease severity as compare to untreated control (Table 1, Line figure 1). Amongst the treatments i.e. three sprays of mancozeb (recommended practice) was found most effective in controlling the disease and enhancing the seed yield followed by 3 sprays of Propiconazole@ 0.1% and Hexaconazole @ 0.1%, respectively (Table-2). These were found at par with each other and were significantly superior to other treatments. Effectiveness of sprays of mancozeb either alone or in combination has already reported by several scientists time to time from different places against Alternaria blight of linseed (Singh *et al.* 1995, Singh *et al.* 2001, Singh,

2002, Khan *et al.* 2004, Singh and Singh, 2004a, Singh and Chandra, 2005, Singh *et al.* 2009, Singh *et al.* 2013) [8, 9, 10, 6, 11, 12, 14, 15]. In present study the effectiveness of mancozeb supports the findings of above scientists. Hexaconazole @ 0.1% was also found at par with Sure in respect of reduced disease severity and increased seed yield in present study. Singh *et al*. (2009) [14] reported Hexaconazole @ 0.1% less effective as compare to mixture of carbendazim + mancozeb in their study against this disease. But in present study 0.1% Hexaconazole was found as effective as sure. This fungicide also increased the seed yield significantly as compare to other treatments. Maximum net return was obtained with three sprays of mancozeb @ 0.2% but 3 sprays of hexaconazole @ 0.1% was found most economical. On the basis of the results of present study these fungicides may be recommended for the management of Alternaria blight disease to the linseed growers. Higher efficacy of mancozeb for management of Alternaria blight may be attributed to the chemical nature and mode of action of fungicides. Singh *et al*. (2001) [9], Khan *et al*. (2004) [6], Singh and Singh (2004b) [11] and Singh *et al*. (2007) [13] also reported that mancozeb @ 0.2% is most effective for management of Alternaria blight of linseed.

Fig 1: Symptoms of Alternaria blight of linseed on leaves and pods

Fig 2: Conidium of *A. linicola*

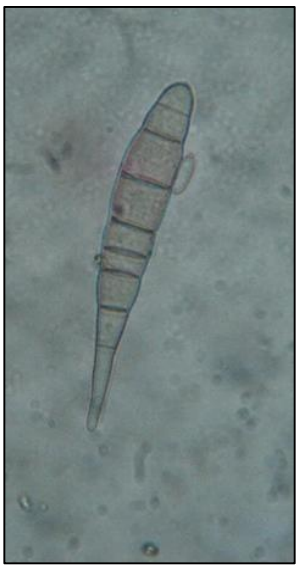

Fig 3: conidium of *A. lini*

Table 1: Effect of different fungicidal and neem oil sprays on the disease severity (PDI) of Alternaria blight.

Treatments	Per cent Disease Intensity (PDI)	Per cent Disease Control (PDC)
Mancozeb @ 0.2%	33.51	42.32
Hexaconazole @ 0.1%	35.86	38.31
Kresoxim-methyl @ 0.1%	37.64	35.21
Carbendazim @ 0.2%	36.75	36.69
Tubaconazole @ 0.1%	39.78	31.58
Propiconazole @ 0.1%	34.65	40.36
Tricyclazole + Mancozeb @ 0.1%	46.94	19.20
Neem oil @ 2%	42.06	27.65
Control (Untreated)	58.13	-
SEm±	3.02	-
CD at 5%	9.04	-

Table 2: Effect of different fungicidal and neem oil sprays on and yield of Alternaria blight

Treatments	Mean yield (Kg/plot)	Kg/ha	Avoidable yield loss (%)	Test weight (g)
Mancozeb @ 0.2%	1.38	1443.75	26.19	5.09
Hexaconazole @ 0.1%	1.28	1334.37	20.14	4.72
Kresoxim-methyl @ 0.1%	1.18	1234.35	13.67	4.48
Carbendazim @ 0.2%	1.22	1271.85	16.22	4.62
Tubaconazole @ 0.1%	1.17	1221.87	12.79	4.35
Propiconazole @ 0.1%	1.32	1381.23	22.85	4.83
Tricyclazole + Mancozeb @ 0.1%	1.11	1162.50	8.34	4.28
Neem oil @ 2%	1.16	1209.39	11.89	4.32
Control (Untreated)	1.02	1065.60	-	3.98
S.Em±	0.03	-		-
CD at 5%	0.08	-		-

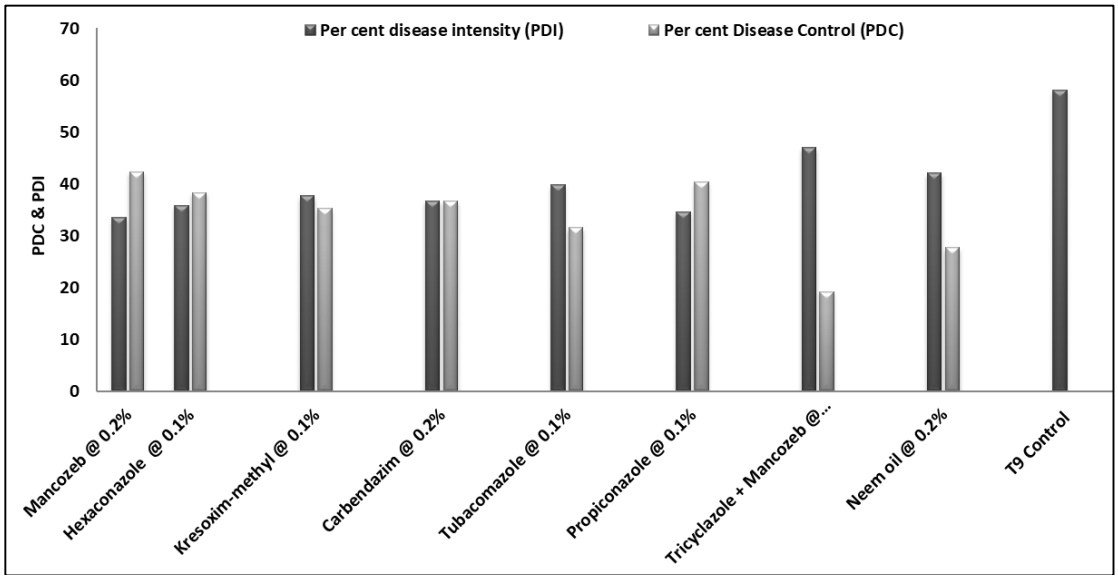

Fig 4: Effect of different fungicidal and extract of Neem oil sprays on the disease severity (PDI) of Alternaria leaf blight

References

1. Campbell CV, Madden LV. Introduction to Plant Disease Epidemiology, John Wiley & Sons, New York City 1990.
2. Chauhan LS, Srivastava KN. Estimation of loss of yield caused by blight disease of linseed. Indian Journal Farm Science 1975;3:107-109.
3. Conn KL, Tiwari JP, Awasthi RP. A disease assessment key for Alternaria black spot in rapseed and mustard. Canadian Plant Disease Survey 1990, 70:19-22.
4. Deyholos MK. Bast fiber of flax (*Linum usitatissimum* L.) biological foundations of its ancient and modern uses. Israel Journals of Plant Science 2006;54:273-280.
5. Gill KS. Evolutionary relationship among *Linum* Species (Ph.D.). University of California, Riverside 1966; CA, USA; 260 pp.
6. Groves JW, Skolko AJ. Note on seed borne fungi, II. Alternaria. Canadian Journal of Research 1944;22:217-234.
7. Khan MN, Singh R, Mishra LK, Awasthi LP. Efficacy of fungicides against Alternaria blight of linseed. Annual of Plant Protection Science 2004;12:451-452.
8. Singh RB, Singh AK, Srivastava RK. Assessment of yield losses due to Alternaria blight of linseed. Journal of Oilseeds Research 2003;20(1):168-169.
9. Singh RB, Srivastava RK, Chauhan YS. Fungicidal management of Alternaria blight of linseed. Indian Journal of Mycology and Plant Pathology 1995;25:117 (Abstract).
10. Singh BK, Singh R, Pant SC. Fungicidal control of cotyledonary leaf blight of linseed. Annual of Plant Protection Science 2001;9:336-337.
11. Singh J. Effect of fungicidal sprays against foliar diseases of linseed. Annual of Plant Protection Science 2002;10:169-170.
12. Singh RB, Singh RN. Management of Alternaria blight of linseed. Annual Plant Protection Science 2004a;12:305-309.
13. Singh J, Chandra R. Relative efficacy and economics of Iprodine and Mancozeb for control of Alternaria blight of Linseed. Annals of Plant Protection Science 2005;13:465-469.
14. Singh R, Singh RB, Singh RN. Spray schedule for the management of Alternaria blight (*Alternaria* spp.) of linseed. Indian Phytopathology 2007;60(4):496-498
15. Singh RB, Singh RN, Singh HK. Evaluation of fungicides and genotypes for the management of Alternaria blight of linseed (*Linum usitatissimum*). Proceedings of National Academic of Science India, Section (B) Biological Science 2009;79(4):410-414.
16. Singh RB, Singh HK, Parmar A. Integrated management of Alternaria blight in linseed. Proceedings National Academic Science India Section (B) Biological Science 2013;83(3):465-469.
17. Vaisey-Genser M, Morris DH. History of the cultivation and uses of flaxseed. In: Muir, A.D., Westcott, N.D. (Eds.), Flax: The Genus Linum. Taylor and Francis Ltd, New York 2003, 1-22.
18. Vanderplank JE. Plant Disease Epidemics and control. Academic Press, New York 1963, 394.
19. Wheeler BEJ. An introduction of Plant Diseases. John Wiley and Sons Limited, London 1969, 301.