Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 101-103
Received: 01-11-2019
Accepted: 03-12-2019

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Management of foliar diseases in blackgram

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Abstract
Blackgram is an important short duration pulse crop grown throughout the year in Andhra Pradesh under different agro-climatic conditions. Though grown in larger area the productivity was low due to biotic and abiotic stresses. Among biotic stresses, diseases are responsible for an estimated yield loss of 20-30%. Among the foliar fungal diseases, powdery mildew, rust and leaf spots are more prevalent. The yield losses are proportional to the disease severity. Hence, the use of fungicides has become inevitable in controlling the foliar diseases in the absence of suitable resistant varieties. Experiment was conducted to find out effective fungicides for the management of foliar diseases in blackgram. Six different fungicides were evaluated under field conditions in which all the treatments tested were significantly superior over control in reducing the incidence of powdery mildew disease. During the experimental periods (*rabi* 2014, 2015 and 2016) there was no incidence of other fungal foliar diseases (rusts & leaf spots). Results showed that carbendazim @ 0.1% proved effective in minimizing the powdery mildew disease incidence by recording lowest Per cent Disease Index (PDI) of 34.15%, seed yield of 925 kg/ha & Cost Benefit ratio of 1:1.68.

Keywords: Fungicides, per cent disease index, carbendazim

Introduction
India is an important pulse growing country contributing 28 per cent to the global pulse basket from an area of about 37 per cent. Urdbean, commonly known as blackgram (*Vigna mungo* L.), is a vital crop grown throughout Asia, Australia, West Indies, South and North America, tropical and sub tropical Africa. Asia alone accounts for 90 per cent of world's blackgram production. India is the world's largest blackgram producer accounting for about 65 per cent world's acerage and 54 per cent of its global production. It is an important short duration pulse crop. Productivity was low due to various biotic and abiotic stresses. The main reasons for low yields are the suceptibility of the crop to insects, weeds and diseases caused by fungus, virus and bacteria.

Among the biotic stress, diseases are responsible for an estimated yield loss of 20 to 30 per cent (Singh, 1995) [1]. Around 45 viruses are reported to infect legumes worldwide. However, only few are of major economic concern with respect to specific regions. Yellow mosaic, *Cercospora* leaf spot and powdery mildew diseases that attack blackgram pulse are considered economically important. Powdery mildew is distributed in India and Southeast Asian countries and becomes severe in dry season causing 9.0-50.0 per cent yield loss (Reddy *et al.*, 2008 and Pandey *et al.*, 2009) [3, 2]. Among foliar fungal diseases, powdery mildew and rust are the more prevalent diseases on blackgram, which occurs at later stages of crop growth. Powdery mildew caused by *Erysiphe polygoni*, is a problem in cool dry weather. Pathogen is obligate parasite and has wide host range (Pandey *et al.*, 2009) [2]. The yield losses caused by foliar disease are proportional to the disease severity depending upon the stage of infection, genotypes and environmental conditions. Yield loss is much high when the pathogen infects the crop before flowering, however, it results in complete loss of the crop if disease occurs at seedling stage.

Abbaiah (1993) [4] reported that the powdery mildew in blackgram was generally noticed in 45 days old crop. Hence, the use of fungicide has become inevitable in controlling the foliar diseases in the absence of suitable resistant cultivars. To overcome this problem, the present study was conducted to test the efficacy of fungicides against foliar fungal diseases of blackgram.

Material and Methods
A field experiment was conducted during *rabi* 2014, 2015 & 2016 at Agricultural Research Station, Utukur to evaluate the efficacy of fungicides against fungal foliar diseases in blackgram. The trial was laid out in Randomized Block Design with six treatments including untreated control each replicated three times with a plot size of 20 sq.m during three years. The blackgram variety, LBG 752 was selected for the study and sowing was done during second

fortnight of October every year at a spacing of 30 cm and 10 cm between rows and plants respectively. The crop was grown under rainfed conditions by adopting all the agronomic practices as per recommendations of ANGRAU.

The first spray was taken up immediately after the initial appearance of the disease symptoms in the experimental field and further sprays were given at 15 days interval with knap-sack sprayer at the rate of 500 L of spray fluid per hectare.

The severity of powdery mildew was recorded one day before the first spray and finally after three sprays using standard disease rating scales during both the seasons. The incidence of powdery mildew was recorded on a 0-5 scale (Mayee and Datar, 1986) [5].

The disease score was recorded as follows

0	No infection	Immune/Resistant
1	1-10% of leaf area infected	Highly resistant
2	10-25% of leaf area infected	Moderately resistant
3	26-50% of leaf area infected	Moderately susceptible
4	51-70% of leaf area infected	Susceptible
5	>70% of leaf area infected	Highly susceptible

Percent disease index (PDI) was calculated using Wheeler's formula (1969) for powdery mildew:

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Total number of leaves examined} \times \text{Maximum disease grade}} \times 100$$

The yield was recorded from each net plot excluding border rows and computed to yield in kg/ha. The data were subjected to statistical analysis after using suitable transformations such as angular transformations for percent disease incidence.

Results and Discussion

In general, the incidence of powdery mildew was high during 2015 when compared to 2014 & 2016 (Table 1). The pooled per cent disease incidence was ranged from 34.15 to 45.96 in different experimental treatments. Results showed that all the tested treatments were proved effective against powdery mildew disease and the maximum mean PDI (58.39) was recorded in control (Table 2).

As per Table 2, *i.e.* pooled data of efficacy of fungicides on foliar disease incidence in blackgram during *rabi* 2014, 2015 & 2016 during *rabi* 2014, 2015 and 2016. T_3 *i.e.* Foliar spray of carbendazim @ 0.1% found to be more effective by recording the PDI of 34.15%, seed yield of 925 kg/ha and C: B ratio of 1:1.68 followed by T_4 *i.e* foliar spray of propineb @ 0.15% with PDI of 36.22%, seed yield of 908 kg/ha and C: B ratio of 1:1.61(Table 2 & 3). The results obtained in the present study revealed that all the treatments significantly increased the seed yield over the untreated control.

Table 1: Management of foliar diseases in blackgram with fungicides during *rabi* 2014, 2015 & 2016

	Name of the treatment	Per cent Disease Incidence (PDI) %			Seed yield (kg/ha)		
		2014 2015 2016			2014	2015	2016
T_1	Mancozeb @0.2%	27.10 (31.36)	46.67(43.08)	43.33(41.13)	1216	640	629
T_2	Chlorothalonil @0.15%	29.00 (32.58)	61.67(51.81)	47.11(43.33)	1105	590	607
T_3	Carbendazim @0.1%	25.90 (30.59)	38.33(38.13)	`37.00 (37.44)	1277	780	780
T_4	Propineb @0.15%	28.42 (32.21)	43.33(41.07)	39.33(38.82)	1233	720	772
T_5	Captan + Hexaconazole (Ally) @0.10%	25.96 (30.63)	45.00(42.11)	42.00(40.39)	1166	670	673
T_6	Propiconazole @0.1%	28.80 (32.46)	48.33(44.04)	47.78 (43.71)	1149	607	600
T_7	Untreated Control	56.04 (48.47)	67.22(55.17)	55.33 (48.07)	1039	565	565
	CD @ 5%	1.26	8.24	6.25	119.11	53.27	45.53
	SEm±	0.41	2.67	2.03	40.09	17.29	14.78
	CV				7.02	4.59	3.87

*Figures in parentheses are angular transformed values

Table 2: Pooled data of efficacy of fungicides on foliar diseases in blackgram during *rabi* 2014, 2015 & 2016

	Name of the Treatment	Pooled Percent Disease Index (PDI) %	Yield (Kg/ha)	Cost Benefit ratio
T_1	Mancozeb @ 0.2%	39.48 (38.92)	812.00	1:1.34
T_2	Chlorothalonil @ 0.15%	45.96 (42.68)	767.00	1:1.18
T_3	Carbendazim @ 0.10%	34.15 (35.73)	925.00	1:1.68
T_4	Propineb @ 0.15%	36.22 (36.97)	908.00	1:1.61
T_5	Captan+Hexaconazole @ 0.10%	37.63 (37.81)	873.00	1:1.52
T_6	Propiconazole @ 0.10%	41.63 (40.18)	785.00	1:1.19
T_7	Control	58.39 (49.86)	723.00	1:1.16
	CD @ 5%	3.25	99.47	-
	SEm±	1.38	32.28	-

*Figures in parentheses are angular transformed values

Table 3: Economics of different fungicides evaluated for foliar disease management in Blackgram during *rabi*, 2014, 2015 and 2016

	Name of the Treatment	Seed yield (kg/ha)	Gross returns (ha $^{-1}$)	Cost of cultivation (ha $^{-1}$)	Cost of the treatment including labour charges (ha $^{-1}$)	Net returns (ha $^{-1}$)	Cost benefit ratio
T_1	Mancozeb @ 0.20%	812	48,720	20,820	820	27,900	1:1.34
T_2	Chlorothalonil @ 0.15%	767	46,020	21,100	1100	24,920	1:1.18
T_3	Carbendazim @ 0.10%	925	55,500	20,670	670	34,830	1:1.68
T_4	Propineb @ 0.15%	908	54,480	20,805	805	33,675	1:1.61
T_5	Captan+Hexaconazole @ 0.10%	873	52,380	20,738	738	31,642	1:1.52
T_6	Propiconazole @ 0.10%	785	47,100	21,450	1450	25,650	1:1.19
T_7	Control	723	43,380	20,000	-	23,380	1:1.16

*Market price of Blackgram was Rs 60/kg

Fig 1: Experimental view of Blackgram

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