INTERNATIONAL JOURNAL OF PLANT PROTECTION
VOLUME 13 | ISSUE 2 | OCTOBER, 2020 | 207-210

● ISSN-0974-2670 | Visit us : *www.researchjournal.co.in*

IJPP

RESEARCH PAPER

DOI : 10.15740/HAS/IJPP/13.2/207-210

Management of powdery mildew of cluster bean through fungi toxicants

■ Arun R. Sataraddi* **and** Jitendra Kumar S. Hilli[1]

Department of Plant Pathology Agriculture Research Station, **Bagalkot (Karnataka) India**
[1]Seeds Unit, University of Agricultural Sciences, **Dharwad (Karnataka) India**

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Received : 29.07.2020
Revised : 12.09.2020
Accepted : 25.09.2020

KEY **W**ORDS : Cluster bean, *leveillula taurica*, systemic fungicides, *In vitro, In-vivo*

***Corresponding author:**
Email : arunsataraddi@gmail.com

ABSTRACT

Leveillula taurica causes severe powdery mildew on all aerial parts of cluster bean plant. The objective of the present work was to identify potential methods for managing cluster bean powdery mildew through fungicides. Field trials were conducted during *Kharif* 2019 and 2020 to evaluate the efficacy fungicides. Nine systemic fungicides were tested both under *in-vitro* and in-*vivo* conditions against cluster bean powdery mildew disease. *In vitro* evaluation of fungicides revealed that complete inhibition of conidial germination was observed in all systemic fungicides at 0.1 per cent concentration. However, under field conditions, penconazole at 0.05 per cent was found to be best fungicide which recorded least incidence 3.66 per cent followed by hexaconazole (5.83%) and propiconazole (6.83%).

How to view point the article : Sataraddi, Arun R. and Hilli, Jitendra Kumar S. (2020). Management of powdery mildew of cluster bean through fungi toxicants. *Internat. J. Plant Protec.*, **13**(2) : 207-210, **DOI : 10.15740/HAS/IJPP/13.2/207-210,**

INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* taub) commnly known as gaur important vegetable crop grown through India. It has assumed considerable importance as an industrial crop of the Indian arid zone in recent years. India is the largest producer of guar seeds with 80 per cent of total production in the world and Rajasthan is leading state producing 75 per cent of total production of India. Cluster bean foliage is subjected to a number of foliage diseases. Among these powdery mildew is an economically important disease caused by *leveillula taurica is* a major foliar disease of cluster bean. It affects most of the commercial varieties of cluster bean under present cultivation. The disease occurs in almost all seasons leading to lower yield and ultimately resulting in high economic losses (Jacob *et al.,*2008). Disease is occurring in an endemic form in most of areas of north Karnataka. Evaluation of fungi toxicants including new generation molecules were undertaken in laboratory and field condition to know their efficacy in controlling the powdery mildew disease subsequently to recommend them in managing the disease over farmer field condition.

MATERIAL AND METHODS

In vitro evaluation of fungicides :

The efficacy of nine systemic fungicides *viz.,* benomyl, benlate Carbendazim, difenconazole, hexaconazole, myclobutanil, propiconazole, penconazole, triadimefon and tridemorph at three concentration were tested against *leveillula taurica* by assessing per cent inhibition of conidia germination. Required concentrations were prepared by dissolving known quantity of fungicide in sterile distilled water separately under aseptic conditions. The conidial suspension was prepared separately in sterile distilled water and adjusted 4 x 10^3 conidia/ ml. Then a drop of a spore suspension was mixed with one drop of fungicidal solution in a cavity slide to achieve the required concentration. In each treatment three replications were maintained. Slides were then incubated at room temperature (25 ± 1°C) for 24 hour. The observation on spore germination was recorded 24 hour after incubation under microscope at 40 x magnification. A control treatment was maintained with sterile water. Per cent conidial germination was calculated by the following formula. The per cent inhibition was calculated by the following formula given by Vincent (1927).

$$\text{Per cent inhibition of spore germination} = \frac{c - T}{c} x100$$

where, c- Germination of conidia in control; t- Germination of conidia in treatment.

In vivo evaluation of fungicides :

A field experiment was conducted during august to November 2019 and 2020 at agricultural research station, Bagalkot under irrigated condition in order to find out suitable fungicide for controlling powdery mildew. The recommended package of practice was followed to raise normal crop. The experiment was laid out in Randomized Block Design (RBD) with 8 treatments and three replications. In each treatment 10 plants were tagged and the effective fungicide found during *in vitro* were studied for their efficacy *viz.,* penconazole (0.1%), difenconazole (0.1%), propiconazole (0.1%), triadimefon (0.1%), Carbendazim (0.1%), hexaconazole (0.1%). And wettable sulphur (0.2%) was tested with one untreated control. The fungicide solutions were prepared by dissolving known quantity of fungicide in water to get desired concentration. The first spray was given on the appearance of the disease and repeated the spray at 10 days interval. The powdery mildew severity was recorded one day before the next spray. Powdery mildew incidence on cluster bean was recorded by using 0–5 scale given below.

Grade	Per cent disease	Reaction
0	No disease	immune
1	1 – 10	Resistant
2	11 – 25	Moderately resistant
3	26 – 50	Moderately susceptible
4	51 – 75	Susceptible
5	>75	Highly susceptible

Per cent disease index (PDI) was calculated by using the formula given by wheeler (1969). At the time of every harvest, tender beans from all treatments were weighed as per the replications separately and average weight was calculated.

RESULTS AND DISCUSSION

The efficacy of nine systemic fungicides on inhibition of conidial germination of *Cichoracearum* differed significantly. At 0.1 per cent concentration all fungicides caused complete inhibition of conidial germination. Irrespective of fungicide concentration, penconazole (91.92%) was found to be the best and significantly superior over rest of the fungicides followed by hexaconazole (90.61%). The results are in conformity with work of Ashwathanarayana (2003).

Before first spray, the incidence of disease was relatively consistent, but on the contrary, after 1st, 2rd and 3rd spray the incidence differs significantly over control.

In 2019 minimum PDI (16.60) was observed in penconazole at 0.05 per cent which was significantly superior over rest of the treatments fallowed by difenconazole with 18.27 per cent severity at 0.1 per cent.Whereas, least effective fungicide was Carbendazim which recorded 28.50 pdi at 0.1 concentration. Significantly highest disease severity of 54.22 PDI was observed with untreated check at the end of the trial. (Sangani *et al*., 2018).

Similarly in 2020 penconazole at 0.05 was found to be effective in reducing the severity of the powdery mildew disease with 16.60 PDI fallowed by difenconazole showing 16.41 per cent disease index. It is clear from Table 2 that penconazole at 0.05 per cent could

Table 1: Effect of different concentration of systemic fungicides on inhibition of conidial germination of *leveillula taurica*

Sr. No.	Treatments	Germination inhibition (%) at concentrations			
		0.05%	0.075%	0.1%	Mean
1.	Benomyl	83.58 (66.03)*	89.61 (71.19)	100.0 (90.00)	91.06 (72.54)
2.	Carbendazim	89.27 (70.81)	100.00 (90.00)	100.0 (90.00)	96.42 (79.06)
3.	Difenconazole	87.76 (69.47)	100.00 (90.00)	100.0 (0.00)	95.52 (77.75)
4.	Hexaconazole	90.61 (72.18)	100.0 (90.00)	100.0 (90.00)	96.87 (79.69)
5.	Myclobutanil	82.36 (65.12)	90.41 (75.13)	100.0 (90.00)	90.92 (72.44)
6.	Propiconazole	85.47 (67.54)	100.0 (90.00)	100.0 (90.00)	95.15 (77.21)
7.	Penconazole	91.92 (73.46)	100.0 (90.00)	100.0 (0.00)	97.30 (80.54)
8.	Triadimefon	81.76 (64.67)	90.34 (76.47)	100.0 (90.00)	90.70 (72.24)
9.	Tridemorph	86.90 (68.78)	100.0 (90.00)	100.0 (0.00)	95.63 (77.89)
	Mean	86.62 (68.53)	96.70 (79.53)	100.00 (90.00)	96.22 (78.76)
	S.E.±	0.255	0.143		
	C.D. (P = 0.01)	0.98	0.567		

* figures in the parentheses are arc sine transformed values

Table 2 : Effect of fungicides on control of powdery mildew of cluster bean and fruit yield

Treatments	PDI 2019	PDI 2020	Pooled	% reduction of disease over control	Average yield (qt/ha)
Penconazole (0.05%)	16.60(24.04)	12.20(20.44)	14.40	76.16	11.41
Triademefan(0.1%)	18.50(25.48)	17.80(24.50)	17.85	70.45	9.92
Propiconazole (0.1%)	26.83(27.13)	25.12(30.07)	25.97	57.01	8.72
Difenconazole (0.1%)	18.27(25.25)	16.41(23.89)	17.34	71.29	10.84
Carbendazim (0.1%)	28.50(32.27)	31.87(34.33)	35.18	41.76	7.84
Hexaconazole(0.1%)	19.83(26.42)	16.21(23.73)	18.02	70.17	10.56
Wettable sulphur (0.3%)	24.16(29.40)	21.38(27.49)	22.72	62.39	7.88
Control	66.40(54.57)	54.43(47.52)	60.41	--	5.11
S.E.±	2.128	1.86			3.184
C.D. (P = 0.01)	6.242	5.321			9.617

significantly control the diseases as compared to other fungicides. It showed average 14.40 disease index and reduced to the extent of 76.16 per cent over control. Next best was difenconzole which recorded average 17.34 per cent disease index and reduced to an extent of 71.29 per cent over control fallowed by hexaconazole, propiconazole and triademefan which are found to be best at 0.1 per cent spray. Several previous studies revealed that, penconazole, difenconzole tridemorph and triadimefon were effective in reducing powdery mildew (singh *et al.,* 1998) and Nofal and wafaa, 2006).

Significantly higher bean yield were observed with all the fungicides treatments than untreated control the results found on yield revealed that, the maximum yield was found in penconazole (11.41 q/ha) followed by difenconzole and hexaconazole. Least percent reduction of disease and yield was noticed in Carbendazim and untreated control.

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