Efficacy of Fungicides against Anthracnose of Green Gram Caused by *Colletotrichum lindemuthianum*

Ankur Patel[1]; Gruhesh R. Chaudhary[2]; R. F. Chaudhary[3*]

[1,2]Student, C.P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujrat, India
[*3]Research Scientist, Agroforestry Research Station, S. D. Agricultural University, Sardarkrushinagar, Gujrat, India
*Corresponding Author

Received:- 14 September 2025/ Revised:- 19 September 2025/ Accepted:- 25 September 2025/ Published: 30-09-2025

Abstract— *Green gram (Vigna radiata L.) is autogamous diploid grain legume crop belonging to Leguminosae family. Anthracnose caused by Colletotrichum lindemuthianum is a serious disease in almost all green gram growing areas. Five systemic, five non-systemic and five ready mixed fungicides were evaluated against C. lindemuthianum under in vitro by poison food technique. Among the systemic fungicides, highest mean inhibition of mycelial growth obtained with tebuconazole (100%) followed by carbendazim (78.33%) and difenoconazole (75.18%). Among the non-systemic fungicides, highest mean mycelial growth inhibition was obtained by copper oxychloride with 100 per cent followed by mancozeb with 84.62 per cent. Among ready mixed fungicides, carbendazim + mancozeb and tebuconazole + trifloxystrobin were significantly higher than the rest of the ready mixed fungicides with 100 per cent mycelial growth inhibition followed by azoxystrobin + difenoconazole and captan + hexaconazole with percentage of 95.37 and 83.42, respectively.*

Keywords— Green gram, Anthracnose, Colletotrichum lindemuthianum, Fungicides.

I. INTRODUCTION

The green gram [*Vigna radiata* (L.) Wilczek] is one of the third most important pulse crop of India after chickpea and pigeonpea. It is autogamous diploid (2n=22) grain legume crop belonging to Leguminosae family. It is also commonly known as mung, mungbean, green gram in India and mungo in Philippines. It is an erect, sub-erect, deep rooted, much branched, somewhat hairy, herb with the height from 30 to 160 cm. It is an ancient and well-known leguminous crop of Asia and India. It is quite versatile crop grown for seeds, green manure and forage.

India is the principal producer of green gram in the world with an annual production of 3.17 million tonnes from an area of 5.5 million hectares with productivity of 570 kg/ha. (Anonymous, 2022a). Green gram total area in Gujarat is 1690.29 ha, productivity 1368.88 MT and yield is 809.85 kg/ha (Anonymous, 2022b). In recent years, anthracnose of green gram caused by *Colletotrichum lindemuthianum* (Sacc. & Magn.) Briosi and Cavara has become one of the serious disease of green gram. In India, the green gram anthracnose was first reported from Jorhat of Assam state during 1951 (Majid, 1953). The average seed yield loss of 40.18 per cent and stalk yield loss of 46.90 per cent was noticed due to anthracnose of green gram (Kulkarni, 2009). Considering the severity of this disease and frequent occurrence in the fields, it has been felt necessity to develop effective management strategies. Thus, attempts have been made to evaluate the efficacy of fungicides against anthracnose disease caused by *C. lindemuthianum.*

II. MATERIAL AND METHODS

The *in vitro* efficacy of five systemic with 100, 250 and 500 ppm, five non-systemic with 1000, 1500 and 2000 ppm and five ready mixed fungicides with 500, 1000 and 1500 ppm were tested against *C. lindemuthianum* by poison food technique (Nene and Thapliyal, 1993) with Completely Randomized Design. This experiment was conducted in Department of Plant Pathology, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, Gujarat during 2024-25. The measured quantities of fungicides were incorporated in melted sterilized PDA medium and poured it into sterilized Petri dishes aseptically. The Petri dishes were inoculated with pathogen in the centre by placing seven days old mycelial disc of 5 mm diameter and then incubated at 25±1ºC temperature. Simultaneously, a suitable control was maintained by growing the fungus

on fungicides free PDA medium. Radial mycelial growth of fungus was recorded on daily basis in control plates starting from the initiation of the fungal growth in correspondence to treatment plated till full mycelial growth of fungus was observed in control. The per cent inhibition of growth of fungus was observed in control. The per cent inhibition of growth of the fungus in comparison with control was calculated by the equation given by Vincent (1947).

III. RESULTS AND DISCUSSION

3.1 Efficacy of systemic fungicides against *C. lindemuthianum:*

Among systemic fungicides, the highest mean mycelial growth inhibition was obtained with tebuconazole (100%) followed by carbendazim (78.33%) and difenoconazole (75.18%). Thiophanate methyl recorded least inhibition of only 65.74 per cent mycelial growth inhibition of the fungus. Tebuconazole at 100, 250 and 500 ppm inhibited 100 per cent mycelial growth of the pathogen. The next best treatment in order of merit were azoxystrobin at 500 ppm, carbendazim at 500 ppm and difenoconazole at 500 ppm which inhibited 83.06, 81.39 and 79.44 per cent mycelial growth inhibition, respectively. Thiophanate methyl at 100 ppm found the least inhibition of only 60.83 per cent mycelial growth of test pathogen (Table 1). Aggarwal *et al.* (2015) reported that tebuconazole was found superior with 100 per cent mycelial inhibition of *C. lindemuthianum* at 250, 500, 1000 and 2000 ppm concentrations. Vani and Somashekhara (2018) also found that tebuconazole (100%) was effective at 1000 ppm *in vitro* for inhibition of mycelial growth of *C. capsici.*

TABLE 1
EFFICACY OF SYSTEMIC FUNGICIDES AGAINST *C. LINDEMUTHIANUM IN VITRO* CONDITION

Tr. No.	Treatments	Per cent growth inhibition			
		Concentration (ppm)			Mean
		100	250	500	
T_1	Difenoconazole 25 EC	57.77	59.83	63.02	60.17
		(71.39)*	(74.72)	(79.44)	(75.18)
T_2	Thiophanate methyl 70 WP	51.24	54.05	57.29	54.19
		(60.83)	(65.56)	(70.83)	(65.74)
T_3	Tebuconazole 25.9 EC	85.91	85.91	85.91	85.91
		(100)	(100)	(100)	(100)
T_4	Carbendazim 50 WP	60.95	61.58	64.57	62.36
		(76.39)	(77.22)	(81.39)	(78.33)
T_5	Azoxystrobin 23 SC	52.9	59.56	65.85	59.43
		(63.61)	(74.17)	(83.06)	(73.61)
T_6	Control	4.05	4.05	4.05	4.05
		(0)	(0)	(0)	(0)
Mean		52.11	54.16	56.78	-
		(62.03)	(65.27)	(69.12)	
S. Em. ±		Treatment	Concentration	Treatment × Concentration	
		0.66	0.46	1.14	
C. D. @ 5%		1.87	1.32	3.25	
C. V. %		4.22			

Figures in parentheses are original values and outside are arc-sine transformed values

3.2 Efficacy of non-systemic fungicides against *C. lindemuthianum*:

Among the five non-systemic fungicides, copper oxychloride was found most effective with highest mean mycelial growth inhibition with 100 per cent per cent found significantly superior over rest of fungicides. Next best fungicides was mancozeb 84.62 per cent mean mycelial growth inhibition. Propineb was found next effective to inhibit 74.25 per cent mycelial growth

inhibition of the fungus and significantly superior over chlorothalonil (68.79%). Cent per cent (100%) growth inhibition of *C. lindemuthianum* was recorded with all the concentrations of copper oxychloride. The next best fungicide was mancozeb at 2000 ppm which inhibited the fungal growth as 88.61 per cent. Fungal growth of the pathogen generally decreased with increased concentration of the tested fungicides (Table 2). Rewale *et al.* (2016) found copper oxychloride and mancozeb were most effective with highest average mycelial growth inhibition of *C. graminicola*. Patel *et al*. (2025) found that copper oxychloride reported superior for mean mycelial inhibition (94.43%) of *C. gloeosporioides* followed by mancozeb (89.10%).

TABLE 2
EFFICACY OF NON-SYSTEMIC FUNGICIDES AGAINST *C. LINDEMUTHIANUM IN VITRO*

Tr. No.	Treatments	Per cent growth inhibition			
		Concentration (ppm)			Mean
		1000	1500	2000	
T1	Propineb 70 WP	55.25	60.37	63.25	59.62
		(67.50) *	(75.55)	(79.72)	(74.25)
T2	Copper oxychloride 50 WP	85.91	85.91	85.91	85.91
		(100)	(100)	(100)	(100)
T3	Chlorothalonil 75 WP	52.54	55.91	59.81	56.08
		(63.05)	(68.61)	(74.72)	(68.79)
T4	Zineb 75 WP	52.22	53.89	55.07	53.72
		(62.5)	(65.27)	(67.22)	(64.99)
T5	Mancozeb 75 WP	64.88	65.95	70.69	67.17
		(81.94)	(83.33)	(88.61)	(84.62)
T6	Control	4.05	4.05	4.05	4.05
		(0)	(0)	(0)	(0)
Mean		52.47	54.34	56.46	-
		(62.49)	(65.46)	(68.37)	
S. Em. ±		Treatment	Concentration	Treatment × Concentration	
		0.57	0.4	0.99	
C. D. @ 5%		1.63	1.15	2.82	
C. V. %		3.66			

Figures in parentheses are original values and outside are arc-sine transformed values

3.3 Efficacy of ready-mix fungicides against *C. lindemuthianum*:

All ready-mix fungicides were found effective at 1500 ppm concentrations. Among them, carbendazim + mancozeb and tebuconazole + trifloxystrobin was found significantly higher than the rest of the ready-mix fungicides with 100 per cent mean mycelial growth inhibition followed by azoxystrobin + difenoconazole and captan + hexaconazole with percentages of 95.37 and 83.42, respectively. Metiram + pyraclostrobin recorded the least mean mycelial growth inhibition of only 74.90 per cent of test pathogen. In combine fungicides, carbendazim + mancozeb and tebuconazole + trifloxystrobin both inhibited 100 per cent mycelial growth at all concentrations tested (500, 1000 and 1500 ppm) and it was at par with azoxystrobin + difenoconazole (99.17%) at 1500 ppm. The next treatment were azoxystrobin + difenoconazole at 1000 and 500 ppm concentrations with 96.39 and 90.56 per cent, respectively. Captan + hexaconazole at 1500, 1000 and 500 ppm concentration with 87.78, 83.33 and 79.17 per cent, respectively. Metiram + pyraclostrobin at 500 ppm was found least effective concentration which recorded 72.78 per cent mycelial growth inhibition of the *C. lindemuthianum* (Table 3). Similar results were obtained in the investigations by Madhusudhan (2002) reported that carbendazim + mancozeb was found superior among the ready-mix fungicides by inhibiting 99.22 and 85.92 per cent growth of *C. truncatum* at 0.25 and 0.2 per cent concentration, respectively. Padghan *et al.* (2023) found trifloxystrobin + tebuconazole with highest efficiency achieving cent per cent inhibition of *C. capsici*. Next best fungicide was Azoxystrobin + difenoconazole.

TABLE 3
EFFICACY OF READY-MIX FUNGICIDES AGAINST *C. LINDEMUTHIANUM IN VITRO*

Tr. No.	Treatments	Per cent growth inhibition			
		Concentration (ppm)			Mean
		500	1000	1500	
T1	Azoxystrobin 18.2 + difenoconazole 11.4 SC	72.33	79.37	84.28	78.66
		(90.56) *	(96.39	(99.17	(95.37
T2	Captan 70 + hexaconazole 5 WP	62.9	65.94	69.55	66.13
		(79.17)	(83.33)	(87.78)	(83.42)
T3	Carbendazim 12 + mancozeb 63 WP	85.91	85.91	85.91	85.91
		(100)	(100)	(100)	(100)
T4	Metiram 55 + pyraclostrobin 5 WG	58.53	59.63	61.67	59.94
		(72.78)	(74.44)	(77.5)	(74.9)
T5	Tebuconazole 50 + trifloxystrobin 25 WG	85.91	85.91	85.91	85.91
		(100)	(100)	(100)	(100)
T6	Control	4.05	4.05	4.05	4.05
		(0)	(0)	(0)	(0)
Mean		61.05	63.46	65.22	-
		(73.75)	(75.69)	(77.4)	
S. Em. ±		**Treatment**	**Concentration**	**Treatment × Concentration**	
		0.5	0.35	0.86	
C. D. @ 5%		1.41	1	2.45	
C. V. %		2.73			

Figures in parentheses are original values and outside are arc-sine transformed values

ACKNOWLEDGEMENT

Department of Plant Pathology, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar help in giving facilities for conducting said research work.

REFERENCES

[1] Aggarwal, S. K.; Mali, B. L. and Rawal,P. (2015): Management of anthracnose in black gram caused by *Colletotrichum lindemuthianum*. *Indian Journal of Mycology and Plant Pathology.* **45**(3): 263-266.

[2] Anonymous, (2022a): Directorate of Economics and Statistics, Department of Agriculture, Co-operation and Farmers Welfare, Ministry of Agriculture, Government of India, New Delhi.

[3] Anonymous, (2022b): Director of Agriculture. Agriculture, Farmers and Welfare Co-operation Department, Government of Gujrat.

[4] Kulkarni, S. A. (2009). Epidemiology and integrated management of anthracnose of green gram (Doctoral thesis, UAS, Dharwad, Karnataka). Retrieved from http://krishikosh.egranth.ac.in/handle/1/69455.

[5] Madhusudhan, B. S. (2002). Studies on soybean anthracnose caused by *Colletotrichum truncatum* (Schw.) Andrus and Moore. M. Sc (Agri.) Thesis, University of Agricultural Science, Bangalore, Karnataka, India. pp. 65.

[6] Majid, S. (1953) Annals Report of Department of Agriculture, Assam for the year 1951-1952 and 1952-1953. *The Grow More Food Campaign*. **11**: 107.

[7] Nene, Y. L. and Thapliyal, P. N. (1993). *Fungicides in plant disease control*. Oxford and IBH Publication Company. New Delhi. pp. 507.

[8] Padghan, P. R.; Mondal, B. and Gade, R. M. (2023). *In vitro* efficacy of different fungicides against *Colletotrichum capsici* causing anthracnose of chilli. *Plant Archives*. **23**(2): 403-406.

[9] Patel, H. R.; Chaudhary, R. F.; Nakrani, B. R. and Patel, N. A. (2025). Efficacy of newer fungicides against leaf and fruit spot of custard apple caused by *Colletotrichum gloeosporiodes*. *International Journal of Environmental and Agriculture Research.* **11**(2): 57-62.

[10] Rewale, K. A.; Deshmukh, R. W.; Gawande, P. N.; Gaikwad, S. H. and Tabolkar, B. B. (2016). *In vitro* evaluation of fungicides against *Colletotrichum graminicola* causing anthracnose of sorghum. *International Journal of Agriculture*. **34**(6): 1695-1700.

[11] Vani, M. and Somashekhara, Y. M. (2018). *In vitro* study of biocontrol agents, fungicides and botanicals against *Colletotrichum capsici* causing anthracnose of capsicum (*Capsicum annuum* L.). *Indian Journal of Pure and Applied Biosciences*. **6**(5): 51-56.

[12] Vincent, J. M. (1947). Distortion of fungal hyphae in presence of certain inhibition. *Nature.* **159**: 239-241.