Evaluation of Fungicides, Organic Amendments and Botanicals against Powdery Mildew of Black Gram in Field Condition

Abstarct

The Paper presents an attempt to explain the potential control of powdery mildew disease of black gram caused by obligate fungus *Erysiphe polygoni*.It causes both quantitative and qualitative losses of grains. The fungicides, botanicals and organic amendments which found best effective were further tested as foliar spray alone as well as in integration of each other for powdery mildew disease suppression. The susceptible black gram variety 'PU 31' was used for this experiment. Lowest powdery mildew severity percent disease index (PDI) after third spray (10.67%) with maximum per cent efficiency of disease control (PEDC) (85.19%) of powdery mildew disease and 9.3 q/ha black gram yield was recorded by foliar spray of Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V 0.1%+ Neem leaf extract 5% + Panchgavya 10% as compared tocontrol with highest (72%) powdery mildew disease severity with lowest 4.12 q/ha yield.

Keywords- Powdery mildew, Black gram, *Erysiphe polygoni* and Field condition, Botanicals, Fungicides, Organic Amendments

Introduction

Black gram [*Vigna mungo* (L.) Hepper] is the most important grain legumes. It is from *Fabaceae* family with 2n=22 Chromosomes and it is believed to have originated in India (Chatterjee and Bhattacharya, 1986). Black gram cultivation is suitable for hot and moist weather condition. Black gram is well known protein rich *kharif* pulse crop in India, which is approximately three times richer than cereals (Kanade, 2006). It is the most important pulse crop in India as it is produced about 2.84 million tonnesannually from about 4.4 million hectares of area and an average productivity is 598 kg per hectare (Anon., 2022).

Black gram is attacked by several diseases like- Anthracnose- *Colletotrichum lindemuthianum*(Sacc. and Magnus) Briosi and Cavara, Bacterial leaf blight- *Xanthomonas phaseoli* (Dowson), *Cercospora*leaf spot- *Cercosporacanescens*(Ellis and Martin), Powdery mildew- *Erysiphe polygoni*(De Candolle), Root rot- *Rhizoctoniasolani*(Kuhn), Rust- *Uromyces phaseoli* (Winter), *Macrophomina*blight- *Macrophominaphaseolina*(Tassi) Goid.,

Yellow mosaic disease- *Mungbean yellow mosaic virus* andLeaf crinkle disease - *Leaf crinkle virus* (Anon., 2014).Powdery mildew of black gram incited by *Erysiphe polygoni*(De Candolle) is the major problem in black gram production, which causes both quantitative and qualitative losses of grains. This disease has been observed severe mainly in late sown *kharif* crop and remains active throughout the year. The powdery mildew disease interferes in photosynthetic activity and causes significant physiological changes in plants, which causes reduction in yield (20-40 per cent) depending on the stage and time at which the disease appears (Legapsi*et al.*, 1978; Singh, 1995).

Material and methods

The present investigation was carried out during *Kharif* 2018. The laboratory studies were carried out in the Plant Pathology Department and the field experiments were conducted at agronomy farm of RCA, MPUAT, Udaipur.

All the chemicals and fungicides used for studies work were of 'Analar' grade quality. The chemicalsPropiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V, Mycobutanil, Hexaconazole and Propiconzolewere used. The organic amendments (*panchgavya*, butter milk and vermiwash) were obtained from Organic farming unit, Rajasthan College of Agriculture, MPUAT, Udaipur and botanicals (neem leaf extract and *Parthenium* leaf extract) were prepared by fresh leaves.

Preparation of botanicals and organic amendments: - fresh leaves were collected from the healthy plants, they first were washed in tap water and then in distilled water. The 100-gramleaves were crushed in 100 ml of sterile water (1:1 w/v) and the material was homogenized for five minutes in mortar and pestle and then the mixture was filtered through two layers of muslin cloth (Sindhan*et al.*, 1999). The obtained extract was considered as a standard (100%) extract and used as a stock solution. Two, five, seven, ten and fifteen per cent concentration of each botanical was prepared by mixing two, five, seven, ten and fifteen ml of stock solution in 98, 95, 93, 90 and 85 ml of sterilized distilled water respectively. The stock solution of vermiwash, panchgavya and buttermilk were also prepared at different concentrations *viz.*,2, 5, 7, 10 and 15% in distilled water.

Field studies: The field experiment was conducted in Randomized block design (RBD) with eight treatments having three replications *viz.*, T_1[Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] @ 0.1%), T_2 (Neem (*Azadiractaindica*) leaf extract@ 5%), T_3 (Panchgavya @10%), T_4 [Propiconazole (13.9%) 15% W/V + Difenconazole

(13.9%) 15% W/V] @ 0.1% + Panchgavya @ 10 %), T_5 [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] SC @ 0.1% + Neem (*Azadiractaindica*) leaf extract @ 5%) T_6 (Neem (*Azadiractaindica*) leaf extract @ 5% + Panchgavya @ 10%), T_7 [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] @ 0.1% + Neem (*Azadiractaindica*) leaf extract @ 5% + Panchgavya @ 10%) and T_8 (Control). The powdery mildew susceptible black gram variety "PU 31" was sown at 30 cm × 10 cmspacing in 1.8 m × 1.9 m plot size.

Identification of the pathogen-

The black gram leaves infected with powdery mildew disease showing the fresh white powdery patches symptoms were collected in early morning and brought to the laboratory for identification of pathogen. With the help of Camel brush, the powdery mass was mounted in the lactophenol on the glass slide. The mounted slides were examined under low and high-power objective lens of a compound microscope to identify the pathogen based on detailed morphological characters of conidia and mycelium described by (Hans and Boeswinkel, 1980; Basu*et al*., 2006 and Patil *et al*., 2017a).

The percent disease index (PDI) was calculated by using following formula given by Wheeler, 1969:

$$PDI = \frac{\text{Sum of all individual disease ratings}}{\text{No. of leaves observed x Maximum disease grade}} \times 100$$

The per cent efficiency of disease control (PEDC) was determined by using following formula:

$$PEDC = \frac{\text{Per cent disease index in control - Per cent disease index in treatment}}{\text{Per cent Disease Index in control}} \times 100$$

Results&Discussion

A field experiment was carried out, black gram variety PU 31 was sown with eight treatment and three replications in Randomized block design (RBD). Based on *in vitro* experiment one fungicide [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1%, one botanical (Neem leaf extract 5%) and one organic amendment (panchgavya 10%) were selected for field evaluation. These treatments

were applied thrice as foliar spray individually as well as in combination at 15 days interval on the black gram plants. The observation of disease severity and development was recorded on a standard disease rating scale (0-5). After 15 days of each spray Per cent Disease Index (PDI) and Per cent Efficiency of Disease Control (PEDC) of each treatment were calculated.

Results depicted from (Table-2) showed that, all the treatments significantly reduced the powdery mildew incidence in black gram variety PU 31. The initial mean powdery mildew severity across all the treatments were ranged from 8 to 13.34%. The per cent disease severity (PDI) recorded 15 days after first spray ranged between 20 to 37.33. The highest disease severity was recorded in control (PDI-38.67). The combination of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Neem leaf extract 5% + Panchgavya 10% was found significantly superior with minimum powdery mildew severity (PDI-20) with 48.28 Per cent efficiency of disease control (PEDC) followed by[Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Panchgavya @ 10% (PDI-24) with 37.93 PEDC, [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Neem leaf extract 5% (PDI-28) with 27.59 PEDC. The individual application of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% exhibited 32% powdery mildew severity with 17.24 PEDC followed by Neem leaf extract 5% + Panchgavya 10% (PDI-34.67) with 10.34 PEDC while, Panchgavya 10% showed 36% powdery mildew severity with 6.9 PEDC that was found at par with Neem leaf extract 5% (PDI-37.33) with 3.45 PEDC.

Powdery mildew severity (PDI) 15 days after second spray ranged from 16 to 34.67 in different treatments. Significantly maximum disease severity was recorded in control (PDI-54.67). The minimum disease severity after second spray was observed in the plots sprayed with the combination of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Neem leaf extract 5% + Panchgavya 10% with 16 per cent disease index and 70.73 Per cent efficiency of disease control (PEDC) followed by [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Panchgavya 10% with 20 per cent disease index and 63.41 PEDC,[Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Neem leaf extract 5% exhibited 24 PDI with 56.10 PEDC. [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% alone showed 28 PDI with 48.78 PEDC, Neem leaf extract 5% + Panchgavya 10% exhibited 30.67 PDI with 43.90 PEDC while the application of Panchgavya 10% alone showed 33.33 PDI with

39.02 PEDC and it was found at par with Neem leaf extract 5% with 34.67 PDI and 36.59 PEDC.

After 15 days of third spray powdery mildew severity (PDI) was ranged between 10.67 to 32. The maximum powdery mildew severity (PDI-72) was recorded in control. The data revealed that minimum powdery mildew severity (PDI-10.67) with 85.19 Per cent efficiency of disease control (PEDC) was recorded in the plots sprayed with the combination of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Neem leaf extract 5% + Panchgavya 10% followed by[Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V]0.1% + Panchgavya 10% showed 14.67 PDI with 79.63 PEDC, [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1% + Neem leaf extract 5% exhibited (PDI-18.67) with 74.07 PEDC, [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V]0.1% alone showed 22.67 PDI with 68.52 PEDC, Neem leaf extract 5% + Panchgavya 10% showed 26.67 PDI with 62.96 PEDC while application of Panchgavya 10% alone showed 29.33 PDI with 59.26 PEDC and it was found at par with Neem leaf extract 5% with 30.67 PDI and 57.41 PEDC.

Among the different treatments significantly highest yield 318 g/plot (9.30 qt/ha) was obtained by the application of the combination of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V]0.1 % + Neem leaf extract 5% + Panchgavya 10% followed by[Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V]0.1 % + Panchgavya 10% obtained 277 g/plot (8.09 q/ha) grain yield. Application of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1 % + Neem leaf extract 5% obtained yield was 241 g/plot (7.05 q/ha) whereas the individual application of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] 0.1 % gave 214 g/plot (6.27 q/ha) grain yield, Neem leaf extract 5% + Panchgavya 10% gave 205 g/plot (5.98 q/ha), Panchgavya 10% 199 g/plot (5.83 q/ha) and application of Neem leaf extract 5% gave 190 g/plot (5.57 q/ha). The minimum yield was obtained from control *i.e*. 141 g/plot (4.12 q/ha) Table-2.

Conclusion

The research of evaluation treatments showed significant control of powdery mildew disease of black gram, there after we suggest to famer for control of this disease applied the

combination of [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V]0.1 % + Neem leaf extract 5% + Panchgavya 10%.

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Table-1 Details of different concentrations of fungicides, botanical and organic amendments used against *Erysiphe polygoniin vivo*:

	Treatments	Per cent Concentration
1. Fungicides		
1.	Taspa 300 SC [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V]	0.05, 0.1, 0.2
2.	Myclobutanil 10% WP	0.05, 0.1, 0.2
3.	Hexaconazole 5% EC	0.05, 0.1, 0.2
4.	Karathane 48% EC	0.05, 0.1, 0.2
5.	Propiconazole 25% EC	0.05, 0.1, 0.2

6.	Control	
2. Botanical and Organic amendments		
1.	Neem(*Azadiractaindica*) leaf extract	2,5,7, 10, 15
2.	Parthenium *(Parthenium hysterophorus*) leaf extract	2,5,7, 10, 15
3.	Panchgavya	2,5, 7, 10, 15
4.	Butter milk	2, 5, 7,10,15
5.	Vermiwash	2, 5, 7, 10,15
6.	Control	-

Table-2. Management of powdery mildew (*E. polygoni*) of black gram in field

Sr. No.	Treatments	*PDI before 1st spray	PDI* After sprayings			PEDC** after spraying			Yield g/plot	Yield q/ha
			First	Second	Third	First	Second	Third		
1	Taspa 300 SC [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] @ 0.1%	9.33 (17.18)	32.00 (34.44)	28.00 (31.94)	22.67 (28.4)	17.24 (24.52)	48.78 (44.28)	68.52 (55.85)	214	6.27
2	Neem leaf extract @ 5%	9.33 (17.70)	37.33 (37.64)	34.67 (36.05)	30.67 (33.60)	3.45 (10.69)	36.59 (37.21)	57.41 (49.24)	190	5.57
3	Panchgavya @ 10%	12.00 (20.08)	36.00 (36.86)	33.33 (35.24)	29.33 (32.77)	6.90 (15.20)	39.02 (38.64)	59.26 (50.32)	199	5.83
4	Taspa 300 SC[Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] @ 0.1% + Panchgavya @ 10 %	10.67 (18.45)	24.00 (29.32)	20.00 (26.55)	14.67 (22.47)	37.93 (38)	63.41 (52.76)	79.63 (63.15)	277	8.09
5	Taspa 300 SC [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] @ 0.1% + Neemleaf extract @ 5%	8.00 (16.42)	28.00 (31.94)	24.00 (29.32)	18.67 (25.56)	27.59 (31.67)	56.10 (48.48)	74.07 (59.37)	241	7.05
6	Neem leaf extract @ 5% + Panchgavya @ 10%	13.34 (21.36)	34.67 (36.05)	30.67 (33.60)	26.67 (31.06)	10.34 (18.75)	43.90 (41.48)	62.96 (52.49)	205	5.98
7	Taspa 300 SC [Propiconazole (13.9%) 15% W/V + Difenconazole (13.9%) 15% W/V] @ 0.1% + Neem leaf extract @ 5% + Panchgavya @ 10%	8.00 (16.07)	20.00 (26.56)	16.00 (23.57)	10.67 (18.98)	48.28 (44)	70.73 (57.23)	85.19 (67.34)	318	9.3
8	Control	12.00 (20.26)	38.67 (38.43)	54.67 (47.66)	72.00 (58.03)	0	0	0	141	4.12
	SEm±	2.33	0.47	0.60	0.92	0.34	0.18	0.01	0.77	0.01
	CD*(P=0.05)*	N/A	1.45	1.83	2.82	1.06	0.55	0.05	2.35	0.04

*Per cent disease index; **Per cent efficiency of disease control; Mean of three replications, Figures given in parentheses are arcsine √ Per cent angular transformed values

Fig: 1 Per cent disease index of fungicide, botanical and organic amendment against powdery mildew of black gram under field condition

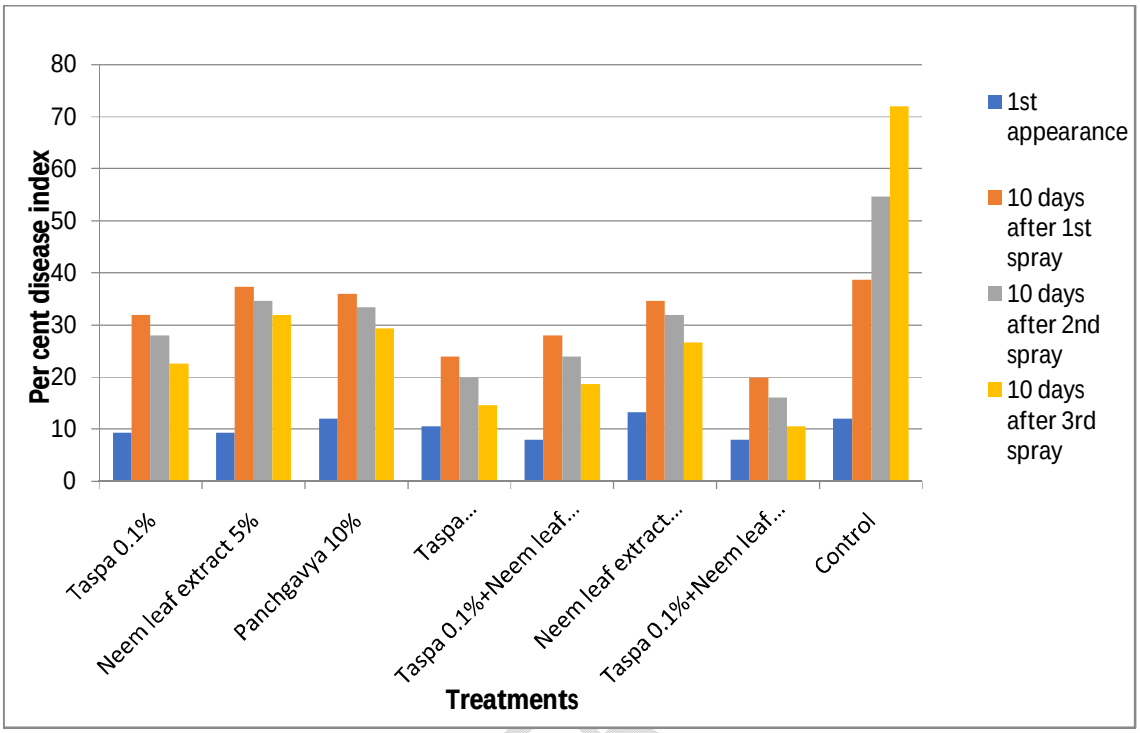

Fig: 2 Per cent efficiency of disease control of fungicide, botanical and organic amendment against powdery mildew of black gram under field condition