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Assessment of disease severity influence by *Alternaria* leaf spot and powdery mildew in organic mungbean (*Vigna radiata* L.)

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Abstract
An experiment was carried out at the Instructional Farm of Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* 2017 and 2018. The experiment was laid out in Randomized Block Design (RBD) with four treatments and six replications. To estimate the disease severity generated by inoculation of most virulent *A. alternata* isolate MAa- 2 cultured in laboratory with 1×10^3 conidia ml^{-1} concentration and in natural conditions of powdery mildew. Pooled analysis for both the years evinced that organically protected plots under inoculations of *A. alternata* showed a minimum PDI of 17.53 which was followed by organically protected plots of powdery mildew under natural conditions with 20.24 PDI. The unprotected plots under inoculations of *A. alternata* and powdery mildew in natural conditions depicted 54.67 and 43.48 per cent disease intensity, respectively.

Keywords: *Alternaria*, powdery mildew, organic, disease severity, mungbean

Introduction
Mungbean (*Vigna radiata* L.), commonly known as greengram is third most important pulse crop among thirteen food legume crops grown in India. Being versatile crop, mungbean is mainly grown for seeds, green manure and forage purpose and is also considered as "Golden Bean" because of it's nutritional values and suitability for increasing the fertility of the soil by way of addition of nitrogen to the soil.

India is contributing 25.08% global pulses in world production from an area of about 34.88% (Anon. 2018-19) [1]. In India, mungbean occupies an area of 47.55 lakh hectares with total production of 24.55 lakh tonnes and productivity of 516 kg per hectare of mungbean (Anon. 2018-19) [1].

Sustainable mungbean production is continuously challenged by biotic stresses, that take a heavy toll of the crop and diseases could cause an estimated yield loss of 40 to 60% (Kaur *et al*., 2011) [5]. Mungbean suffers from many diseases caused by fungi, bacteria, viruses, nematodes. Among the diseases, *Alternaria* leaf spot and powdery mildew are major foliar diseases which cause considerable qualitative and quantitative losses in the mungbean. *Alternaria* leaf spot was reported from Udaipur, India causing 80 per cent incidence at the age of 65 days and affecting about 45 per cent leaf area (Gupta, 1970) [3]. Powdery mildew is also a destructive disease which causes huge losses up to 50-90% under Indian condition (Gupta and Mate, 2009) [4].

Now a day, *Alternaria* leaf spot disease has emerged as a serious disease and known to cause wide spread damage in mungbean crop. It shows variability with respect to cultural, morphological, physiological and pathological characteristics. The isolation from different areas has been found to be differing with varying virulence and sporulation. Therefore emphasis on cultural, morphological and pathogenic variability of *Alternaria* leaf spot has been made in the present investigation.

In organic agriculture, management is directed towards preventing problems, while stimulating processes which assist in nutrition and pest & disease management. Besides, management of pest and diseases through organic methods is one of the important constraints in enhancing productivity of mungbean.

Material and Methods
Field experiment were carried out at the Instructional Farm of Rajasthan College of

Agriculture, MPUAT, Udaipur during *kharif* 2017 and 2018 which is situated at latitude 24.55° N, longitude of 73.71° E and altitude of 598.00 meters above Mean Sea level (MSL). The region falls under Sub-humid southern plains (Climatic Zone- IVa) of Rajasthan. The trial was laid in Randomized Block Design (RBD) with four treatments and six replications. The seeds of local susceptible cultivar of mungbean were sown in last week of July with a spacing of 30 cm and 10 cm between rows and plants, adopted in plot size of 3×2.4m, respectively. Observations on the disease severity in unprotected and organically protects plots were recorded.

Generally, *Alternaria* and powdery mildew disease appeared at 30-40 days after sowing. Observations for disease severity were recorded on randomly selected five plants of upper, middle and lower leaves from per plot. Visual scoring as per the standard1-5 disease rating scale as given by Sangeetha and Siddaramaiah (2007) [6] for *Alternaria* leaf spot and Adinarayana *et al*., (2012) [2] for powdery mildew, respectively.

Numbers of plants in each score were recorded and the PDI in each plot was determined as:

$$PDI = \frac{n \times 1 + n \times 2 + n \times 3 + n \times 4 + n \times 5}{N} \times \frac{100}{\text{Maximum disease score } (5)}$$

Where,
n = Number of plants in each score, 1-5 = disease score
N = Total number of plant under observation

Result and Discussion

The results and discussion of the experiment conducted on various aspects of *Alternaria* leaf spot and powdery mildew of organically grown mungbean with reference to evaluation of disease severity (PDI) affected by organic practices are presented here under. In present study, the results of the field experiment presented in Table 1 clearly indicate that the disease severity was significantly low in all the treated plots compared to the unsprayed control plot after two sprays. Disease intensity was recorded three times at before spray, 10 days after first spray and 10 days after second spray of organic amendments, respectively. The first spray of organic fungicidal treatment was applied at 35 days after sowing and the second was given at 45 days after sowing an interval of 10 days.

The field experiments were carried out in two consequent seasons (*Kharif* 2017 and 2018) to estimate the disease severity generated by inoculation of most virulent *A. alternata* isolate MAa- 2 cultured in laboratory with 1×10^3 conidia ml^{-1} concentration and in natural conditions of powdery mildew. Isolation and purification of the *Alternaria* pathogen was done in the laboratory from the symptomatic leaves of mungbean plants collected from farmer's field. Along with inoculated plots, organically protected plots for respective pathogens were also maintained for comparison. This way, the whole experiment was laid out in Randomized Block Design (RBD) with four treatments and six replications. Observations on the disease severity in unprotected and organically protects plots were recorded. The data so obtained have been presented in Table 1 described as under.

Table 1: Assessment of disease severity in mungbean due to *Alternaria* leaf spot and powdery mildew disease during *Kharif* 2017 and 2018

S. No.	Treatments	Per cent disease Index (PDI)		
		2017-18	2018-19	Pooled
1.	Under inoculations *Alternaria* sp. with 1×10^3 conidia ml^{-1} concentration	56.93 (49.00)	52.41 (46.38)	54.67 (47.69)
2.	Organically protected *Alternaria* sp. under inoculations with 1×10^3 conidia ml^{-1} concentration	18.74 (25.60)	16.32 (23.76)	17.53 (24.68)
3.	Under natural conditions powdery mildew	42.17 (40.49)	44.79 (42.01)	43.48 (41.25)
4.	Organically protected powdery mildew under natural conditions	20.81 (27.09)	19.67 (26.27)	20.24 (26.68)
S.Em±		1.13	1.02	0.92
CD at 5%		3.39	3.08	2.66
CV%		6.33	5.90	6.12

Figures in parentheses are arcsine √per cent transformed values

The results revealed that, data in Table 1, it was observed that unprotected plots had a significantly higher incidence of disease as compared to organically protected plots during both the years. During 2017, the mean disease severity in plots under inoculations of *A. alternata* was recorded as 56.93 per cent, whereas, in organically protected plots of *A. alternata* inoculation, the disease intensity was reduced to be 18.74 per cent. Likewise, the severity of powdery mildew disease under natural conditions in unprotected plots was 42.17 per cent, which was suppressed by means of organic methods in protected plots and recorded as low as 20.81 per cent. In the next year (2018), the results were similar to that of previous year. Unprotected plots with inoculations of *A. alternata* exhibited 52.41 PDI and plots with powdery mildew under natural conditions showed 44.79 PDI. In protected plots for both the diseases, the disease intensity was brought down to 16.32 and 19.67 per cent by the use of organic methods.

Pooled analysis for both the years evinced that organically protected plots under inoculations of *A. alternata* showed a minimum PDI of 17.53 which was followed by organically protected plots of powdery mildew under natural conditions with 20.24 PDI. The unprotected plots under inoculations of *A. alternata* and powdery mildew in natural conditions depicted 54.67 and 43.48 per cent disease intensity, respectively.

Conclusion

It was observed that unprotected plots had a significantly higher incidence of disease as compared to organically protected plots during *kharif* 2017 and 2018. The losses caused by a disease vary with the host pathogen combination and the disease severity. Recommended agronomical practices and mechanical removal of weeds were used in organically protected plots.

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