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Survey of the disease incidence of Cercospora leaf spot of mungbean [*Vigna radiata* (L.) Wilezek] in Eastern Uttar Pradesh

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Abstract
Mungbean (*Vigna radiata* L.) is short duration legume crop belongs to family Leguminosae, Mungbean is important pulse crop of India, it is widely cultivated throughout the primarily a rainy season crop but with the development of early maturing varieties, though they get highly affected from the disease. Survey of different five districts mainly Jaunpur, Varanasi, Chandauli, Azamgarh and Mirzapur under ten blocks such as Badlapur, Mariahu, Pindra, Sevapuri, Niyamatabad, Sakaldiha, Lalganj, Phoolpur, Jamalpur and Narayanpur were conducted in *Kharif* 2019–2020 and 2020–2021 to determine the prevalence and severity of foliar diseases, in particular the mungbean leaf spot disease (Cercospora leaf spot disease) caused by *Cercospora canescens*. The findings revealed that the highest incidence of leaf spot was documented in Mirzapur district (70.03-72.81%) during the first year, followed by Chandauli (59.68-63.89%), Azamgarh (43.07-45.17%), Jaunpur (34.66-37.43%), with the lowest incidence in Varanasi district (24.56-27.68%). In the second year, a similar trend persisted, with Mirzapur (69.82-72.40%) having the highest incidence, followed by Chandauli (59.08-63.27%), Azamgarh (41.59-44.11%), Jaunpur (34.00-35.30%), and the lowest incidence observed in Varanasi district (23.13-26.65%).

Keywords: Mungbean, disease incidence, districts, survey, Cercospora

Introduction
In India, mungbean (*Vigna radiata* L.), a kind of plant in the legume family, is referred to as moong or green gram. Its principle source is India, and it is primarily grown in the Indian subcontinent, East Asia, and South East Asia. According to Singh *et al.*, (1970) [4] and Jain and Mehra (1980) [3], mungbean originated in India or the Indo-Burma region. Mungbean is important pulse crop of India, it is widely cultivated throughout the primarily a rainy season crop but with the development of early maturing varieties, it has also proved to be an ideal crop for spring and summer season. With a nutritional content of 21.1% protein, 67.5% carbohydrates (Adams 1975) [2], 0.11g fat, 0.37g ash, 15 mg calcium, and 0.12 to 1.13 mg of vitamins, mungbean is an excellent source of both protein and vitamins (Zhu *et. al*., 2018) [5]. The main producers of mungbean beans are China, Fiji, India, Burma, Sri Lanka, Pakistan, Africa, and Queens Land. Mungbean is cultivated in practically every state in India, which leads the world in production. It is produced on roughly 4.5 million hectares, yielding 2.5 million tons at a productivity of 548 kg/ha, or 10% of the world's total production of pulses. According to Government of India 3rd advance estimates, mungbean production is at 2.64 million tones (Annual Report 2021-22) [1]. The states that grow and produce the most mungbean are Andhra Pradesh, Gujarat, Madhya Pradesh, Orissa, Rajasthan, Maharashtra, and Bihar.

Among these diseases, leaf Cercospora leaf spots (*Cercospora beticola*) has been identified as an economically important disease in this region which causes considerable yield losses 23%. Maximum loss of 61% was observed in case of grain. These conidia play a role of primary inoculum in disease incidence. Rain splashes also play as a major role in dispersal of conidia (William, 1987) [6]. Cercospora leaf spot is considered as an important pathogen not only due to its widespread range but also due to the susceptibility of many commercial crops

to this disease. Described the symptoms of *C. beticola* on *V. radiata* as a fungus producing definite spots on leaves, which were at first brown, later turning grey or dirty grey with narrow reddish brown margin bearing fructifications on both the surfaces. Warm wet conditions are favourable for Cercospora leaf diseases. Epidemiological conditions for the production of conidia require 90-100 percentage relative humidity and 20-26 °C temperature. For germination and to cause the infection the ideal temperature recorded is 25-30 °C.

Material and Methods

Five districts, primarily Jaunpur, Varanasi, Chandauli, Azamgarh, and Mirzapur, were surveyed in order to determine the mungbean leaf spot in eastern Uttar Pradesh well distributed geographical two blocks each districts *viz*., Badlapur, Mariahu, Pindra, Sevapuri, Niyamatabad, Sakaldiha, Lalganj, Phoolpur, Jamalpur and Narayanpur.

The leaves were collected randomly from 25 plants while moving in zigzag fashion after starting from one corner of the field. The leaves were brought to laboratory in paper bags and then categorized according to 0-7 rating scale, where 0 = no infection, 1 = One spot to 20 percent diseased area, 3 = 21–40 percent diseased area, 5 = 41–60 percent diseased area, and7 = >60 percent diseased area. The following formula was used to determine the severity of the condition. The severity of disease was recorded in percentage of disease incidence with the formula.

$$\text{Disease Intensity (\%)} = \frac{\sum (nv)}{NG} \text{ x100}$$

Where,

n=number of leaves in a category, v=numerical value of category, N=total of leaves examined and G=maximum category value.

Results and Discussion

Survey of different five districts mainly Jaunpur, Varanasi, Chandauli, Azamgarh and Mirzapur under ten blocks such as Badlapur, Mariahu, Pindra, Sevapuri, Niyamatabad, Sakaldiha, Lalganj, Phoolpur, Jamalpur and Narayanpur were conducted in *Kharif* 2019–2020 and 2020–2021 to determine the prevalence and severity of foliar diseases, in particular the mungbean leaf spot disease (Cercospora leaf spot disease) caused by *Cercospora canescens*. In both years, the first and third weeks of September were used for the survey work. September is a good month to conduct surveys because of the month's favorable humidity and temperature for the incidence of leaf spots.

Table-1 makes it clear that, during the first year of the study (2019–20), the district with the highest incidence of leaf spot was Mirzapur (70.03–72.81 percent), followed by Chandauli (59.68–63.89 percent), Azamgarh (43.07–45.17 percent), Jaunpur (34.66-37.43 percent), and district Varanasi (24.56-27.68 percent).

District Mirzapur consequently emerged as this year's leaf spot hot area. The same path and pattern were also used for survey and surveillance activities in 2020–21. According to observations made during the second year of the study, the district with the highest incidence of leaf spot was Mirzapur (69.82-72.40 percent), followed by Chandauli (59.08-63.27 percent), Azamgarh (41.59-44.11 percent), and Jaunpur (34.00-35.30 percent). The district with the lowest incidence was Varanasi (23.13-26.65 percent).

Table 1: Prevalence of Cercospora leaf spot in mungbean during *kharif* 2019-20 and 2020-21

Districts	Blocks	Disease intensity (%) 2019-20				Disease intensity (%) 2020-21			
		Location 1	Location 2	Location 3	Mean	Location 1	Location 2	Location 3	Mean
Jaunpur	Badlapur	32.13	35.34	36.53	34.66	31.23	35.14	35.65	34.00
	Mariahu	34.42	38.21	35.67	37.43	34.12	37.23	34.56	35.30
Varansi	Pindra	26.33	23.21	24.15	24.56	25.03	21.24	23.12	23.13
	Sevapuri	27.27	25.71	30.08	27.68	26.21	24.53	29.23	26.65
Chandauli	Niyamatabad	60.25	57.43	61.36	59.68	60.15	56.33	60.76	59.08
	Sakaldiha	62.32	64.11	65.25	63.89	61.12	63.56	65.15	63.27
Azamgarh	Lalganj	38.53	43.23	47.46	43.07	37.23	41.22	46.34	41.59
	Phoolpur	43.35	46.50	45.67	45.17	42.25	45.67	44.43	44.11
Mirzapur	Jamalpur	68.21	71.36	70.54	70.03	68.14	70.56	70.76	69.82
	Narayanpur	70.32	73.45	74.67	72.81	70.12	72.65	74.45	72.40
Overall average					47.89	Overall average			46.95

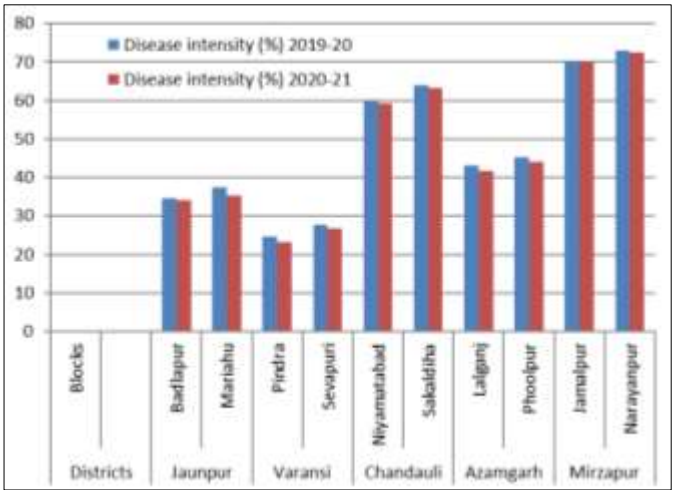

Fig 1: Survey, prevalence and severity of Cercospora leaf spot disease of mungbean different growing area

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