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Research Journal of Agricultural Sciences  
An International Journal

P- ISSN: 0976-1675

E- ISSN: 2249-4538

Volume: 13

Issue: 04

*Res. Jr. of Agril. Sci.* (2022) 13: 1140–1144

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# Prevalence of *Alternaria* Blight of Rapeseed-Mustard in Different Districts of Uttar Pradesh

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Received: 20 Apr 2022 | Revised accepted: 25 Jul 2022 | Published online: 27 July 2022  
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## ABSTRACT

An extensive field survey was conducted to assess the incidence and severity of *Alternaria* blight of rapeseed-mustard during *rabi* seasons of 2016-17 and 2017-18 at different farmer's fields in different districts of Uttar Pradesh. The pooled data of two years (2016-17 and 2017-18) indicated a considerable variation in the incidence and severity of *Alternaria* blight in different surveyed districts. The disease incidence and severity in these surveyed districts ranged from 35.67 to 69.20% and 27.61 to 55.29%, with an overall average of 51.56 and 42.03%, respectively. The disease was found to be in each village of twenty districts, but significantly maximum disease incidence and severity (69.20% and 55.29%) was recorded in district Moradabad followed by district Hathras (65.02% and 51.84%), thereby exhibiting significant differences from each other. However, minimum per cent disease incidence and severity was observed in district Agra (35.67% and 27.61%) followed by Gautam Buddh Nagar (38.53% and 33.96%) and Ayodhya (40.68% and 35.27%).

**Key words:** *Alternaria* blight, Disease incidence, Disease severity, Rapeseed-mustard, Survey

Rapeseed-mustard is third most important oil yielding cash crop after soybean (*Glycine max*) and palm (*Elaeis guineensis* Jacq.) and contributing about 9.8% of total world production [1-2]. In India, this crop is grown in an area of 6.12 mha with a production of 9.26 mt annually and an average yields of 1511 kg/ha [3]. Amongst, Indian mustard (*Brassica juncea*) is an important and predominant *Rabi* oilseed crop being cultivated at large scale in the Indian subcontinent. This cash crop keeps wide range of significance from daily uses to industrial applications.

More than thirty different diseases have been encountered posing threat to this crop, cause substantial yield losses, affect seed quality and oil content leading to poor market value [4-5]. *Alternaria* blight (*Alternaria brassicae*) has recently become a severe headache for the growers which has significantly reduced the qualitative and quantitative performance of this crop. *Alternaria* blight is known to be most widespread and destructive fungal disease across the world. The disease is polycyclic in nature, and the pathogen is known to survive as mycelium/conidiospores or conidia on the plant debris of the previous year's crop [6] or in susceptible weeds or perennial crops [7] or in the infected seeds for at least one year at room temperature [8-9]. The disease is an internationally well-known problem and severely affects the quality of the seed

and causes seed discoloration, reduce its size, weight and oil contents due to premature ripening and shedding of seed before harvest [10-11]. *Alternaria* blight causing pathogens can attack all the aerial parts of plant and can cause huge losses in yield. Mustard crop may exhibit a range of symptomatic variation (17-22%) and upto 47% if congenial environment is prevailed [12-13]. The disease has also been reported by many researchers in different agro climatic zones of Uttar Pradesh. But correct and accurate information of natural incidence and severity of the disease particularly in eastern and western Uttar Pradesh is still scanty and meagre.

The present study was an attempt to monitor the occurrence of this disease in different mustard growing districts of Uttar Pradesh. The study has provided a single pot information pertaining to disease incidence of *Alternaria* spp. which will help us find congenial management solutions to this devastating pathogen.

## MATERIALS AND METHODS

To ascertain the prevalence of *Alternaria* blight disease in rapeseed-mustard, an extensive field survey was carried out during *rabi* seasons (2016-17 and 2017-18) at farmer's fields in twenty districts of Uttar Pradesh (Table 1, Fig 1). The observation was done during the month of January to March of each cropping season from pre-flowering to pod formation/maturity stage. Five hundred heterogenous fields were monitored in identified districts. Five villages and five fields from each district and village, respectively were surveyed. 1m × 1m area was marked at five selected spots in each farmer's field.

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Plants showing characteristic symptoms of the *Alternaria* blight were taken into considerations. Such disease samples

were collected and brought to the laboratory for further investigations. Soil texture was also noted in identified districts.

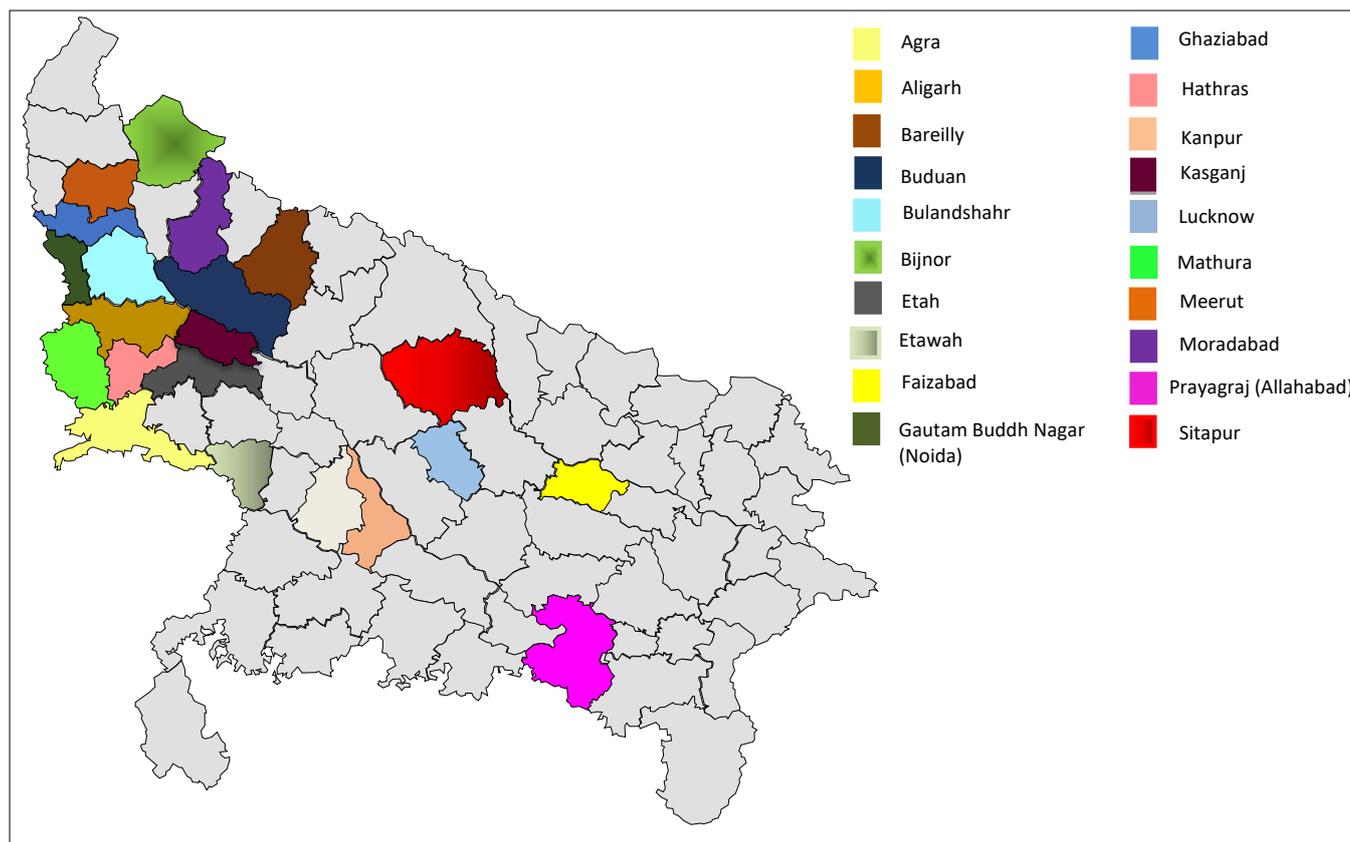


Fig 1 Twenty different districts of Uttar Pradesh surveyed for collection of samples and monitoring of *Alternaria* blight prevalence

#### Data recordings

Disease incidence, disease severity were recorded using following general formula:

$$\text{Disease incidence (\%)} = \frac{\text{Total number of infected plants}}{\text{Total number of plants}} \times 100$$

$$\text{Disease severity (\%)} = \frac{\text{Sum of all numerical rating}}{\text{Number of leaves/pods examined} \times \text{Maximum grade}} \times 100$$

#### Statistical analysis

All data were subjected to analysis of variance (ANOVA) for their normalization. Other complemental calculations were done in “R” and MS Word 2010.

## RESULTS AND DISCUSSION

The incidence and severity of *Alternaria* blight disease in rapeseed-mustard significantly varied in all twenty major rapeseed-mustard growing districts of Uttar Pradesh. The disease incidence and disease severity in these surveyed districts ranged from 35.67 to 69.20% and 27.61 to 55.29% with an overall average of 51.56 and 42.03%, respectively.

The disease appeared in each village of twenty districts, however, significantly maximum disease incidence and severity (69.20% and 55.29%) was recorded in district Moradabad followed by Hathras (65.02% and 51.84%), respectively, exhibiting significant differences from each other (Table 1). The minimum per cent incidence and severity was observed in Agra (35.67% and 27.61%), and it was found to be significantly at par with that recorded in Gautam Buddha Nagar (38.53% and 33.96%) and Ayodhya (40.68% and 35.27%) (Table 1).

The pooled data indicated a considerable variation in the incidence and severity of *Alternaria* blight in different villages of surveyed districts. The maximum incidence (73.57%) was recorded in village Baheri of district Moradabad, and the minimum (32.64%) was in Bichpuri village of districts Agra (Table 1). Maximum disease severity (56.71%) was recorded in Jaitpur village of Moradabad, and the minimum (24.58%) was in Runkata village of Agra.

With regards to the soil texture in the villages of twenty districts, it was found that soil of all surveyed field of different districts exhibited variation in their soil texture. Sandy soil texture was found in district Agra, Aligarh, Buduan, Etah; loamy soil was observed in Bulandshahr, Gautam Buddha Nagar, Ghaziabad, Hathras, Kasganj, Mathura, Meerut, and Moradabad. However, Sandy loam texture was recorded in Etawah, Ayodhya, and Kanpur district. Silty loam soil texture was found in Bareilly, Lucknow, Sitapur district. Prayagraj had sandy clay loam texture, Bijnor had Clayey loam (Table 1). Maximum disease incidence and severity (71.32% and 55.29%) was found in Loamy texture of soil in Moradabad. Minimum incidence and severity (35.67% and 27.61%) was observed in sandy soil of Agra district.

It is, therefore, clear from the present study that during both years of the survey (2016-17 and 2017-18), the prevalence of *Alternaria* blight in rapeseed-mustard varied significantly in twenty different districts of Uttar Pradesh. Maximum incidence and severity was noted in Moradabad followed by Hathras, Kasganj, Mathura, and Lucknow and minimum was in Agra. This fact has also been testified with the record of maximum incidence and severity of the disease in the village Baheri and Jaitpur of Moradabad, respectively, and minimum incidence and severity in Bichpuri and Runkata village of Agra, respectively.

Plate 1 Symptoms of *Alternaria* blight on mustard (a) Leaves, and (b) siliquaeTable 1 Incidence and severity of *Alternaria* blight on rapeseed-mustard in different villages of twenty districts of Uttar Pradesh during *rabi* seasons of 2016-17 and 2017-18

District	Villages	Coordinates		Soil texture	Disease incidence (%)	Disease severity (%)
		Longitude (E)	Latitude (N)			
Agra	Bichpuri	77°54'32.6	27°10'27.1	Sandy soil	32.64 F	30.80y-D
	Laramda	77°53'56.5	27°09'58.4	Sandy soil	38.16 A-F	27.76B-D
	Raipura jat	77°48'09.7	27°16'19.0	Sandy soil	35.87 D-F	24.83CD
	Runkata	77°52'07.7	27°14'26.7	Sandy soil	36.23 D-F	24.58D
	Sahpur	77°47'04.7	26°55'07.9	Sandy soil	35.48 EF	30.12z-D
		Mean			35.67	27.61
Aligarh	Asgarpur	78°11'57.8	27°49'04.0	Sandy soil	46.85m-F	39.08k-B
	Balukhera	78°12'53.7	27°48'41.6	Sandy soil	46.43m-F	43.68d-w
	Bhatauli	78°11'51.3	27°47'51.2	Sandy soil	40.05x-F	40.77i-A
	Jasrathpur	78°11'52.9	27°50'22.1	Sandy soil	51.54f-D	43.03f-x
	Rohina Singh Pur	78°13'23.3	27°49'41.9	Sandy soil	50.43g-E	43.59e-w
		Mean			47.06	42.03
Ayodhya	Babua pur	82°22'06.0	26°39'37.4	Sandy loam	40.18x-F	31.81x-D
	Chirkiitha	82°23'58.0	26°33'21.7	Sandy loam	41.08v-F	36.03p-D
	Rakaura	82°19'55.5	26°40'48.7	Sandy loam	45.88n-F	39.99k-A
	Sonora	82°22'10.3	26°38'01.6	Sandy loam	35.67EF	39.18k-B
	Toniya	82°08'54.3	26°43'35.1	Sandy loam	40.63w-F	29.34A-D
		Mean			40.68	35.27
Bareilly	Alampur	79°20'37.8	28°14'54.1	Silty loam	55.30d-x	39.91k-A
	Dalpatpur	79°19'43.3	28°10'54.1	Silty loam	44.92p-F	42.24g-y
	Kalari	79°29'41.4	28°23'54.1	Silty loam	45.28o-F	47.44a-q
	Khanpur	79°23'15.2	28°31'14.9	Silty loam	49.47i-E	48.32a-n
	Lakhaura	79°25'40.2	28°17'34.0	Silty loam	43.38r-F	41.65g-z
		Mean			47.67	43.91
Bijnor	Amhera	78°17'05.2	29°15'54.3	Clayey loam	56.73b-v	44.99b-u
	Bharaira	78°09'59.3	29°22'31.2	Clayey loam	57.09b-u	40.67j-A
	Gopalpur	78°07'29.2	29°34'54.4	Clayey loam	58.85a-s	47.73a-p
	Kishanpur	78°10'28.6	29°28'00.9	Clayey loam	59.37a-q	42.72f-x
	Taupri	78°11'24.2	29°21'21.6	Clayey loam	56.28b-w	47.04a-r
		Mean			57.36	44.62
Budaun	Bamni	79°14'44.3	27°58'50.5	Sandy soil	52.26f-C	43.88d-v
	Basant Nagar	79°04'25.1	28°03'48.4	Sandy soil	49.34i-E	36.28p-D
	Husainpur Pukhta	78°51'01.5	27°58'29.2	Sandy soil	60.85a-o	49.55a-l
	Jamrauli	79°01'55.2	28°02'29.3	Sandy soil	62.81a-l	43.35e-x
	Kartoli	79°15'12.4	28°10'10.5	Sandy soil	56.15b-w	48.68a-m
		Mean			56.06	44.35
Bulandshahr	Chandpur	77°49'31.2	28°23'36.2	Loamy soil	42.98t-F	35.33r-D
	Dhakauli	78°01'57.8	28°32'28.2	Loamy soil	48.25j-F	43.09f-x
	Kanauna	78°04'28.0	28°30'34.1	Loamy soil	43.49r-F	39.08k-B
	Khanpur	78°03'30.4	28°31'55.0	Loamy soil	45.11o-F	36.50o-C
	Manpur	77°52'26.3	28°30'58.6	Loamy soil	39.37y-F	36.47o-C
		Mean			43.83	38.09
Etah	Daspur	78°54'03.7	27°30'10.2	Sandy soil	43.14s-F	38.58l-B
	Kawar	78°43'38.3	27°28'48.3	Sandy soil	48.93i-E	37.18m-B
	Labheta	78°48'29.6	27°31'40.2	Sandy soil	53.65e-A	32.36v-D
	Pipehra	78°45'11.8	27°29'47.5	Sandy soil	53.06e-B	37.33m-B
	Piwari	78°33'10.6	27°46'15.6	Sandy soil	45.36n-F	35.77q-D

			Mean		48.82	36.24
Etawah	Ahladpur	79°02'08.0	26°49'16.2	Loamy sand	42.42u-F	46.55
	Aswa	78°54'06.5	26°46'14.8	Loamy sand	36.59C-F	38.00I-B
	Bela	78°50'58.7	26°45'53.9	Loamy sand	44.41q-F	38.00I-B
	Ritoli	79°07'46.3	26°49'28.7	Loamy sand	47.32I-F	40.22k-A
	Sakatpur	78°52'41.1	26°48'22.4	Loamy sand	46.56m-F	39.94k-A
			Mean		43.45	40.54
Gautam Buddha Nagar	Bagpur	77°35'26.6	28°23'57.1	Loamy soil	35.43EF	32.08w-D
	Bisaich	77°34'26.0	28°24'18.0	Loamy soil	37.38B-F	32.17v-D
	Dankaur	77°33'34.2	28°21'10.1	Loamy soil	37.78B-F	32.53v-D
	Kidawali	77°23'20.7	28°28'18.7	Loamy soil	39.00z-F	35.14s-D
	Nagla Nagli	77°23'09.9	28°29'42.6	Loamy soil	43.09t-F	37.93I-B
			Mean		38.53	33.96
Ghaziabad	Bahadurpur	77°24'45.3	28°45'21.4	Loamy soil	54.50d-z	45.18a-u
	Inayatpur	77°31'55.0	28°38'51.8	Loamy soil	61.98a-m	45.63a-t
	Khora	77°24'01.4	28°45'19.7	Loamy soil	50.97f-E	42.35g-y
	Matiala	77°30'07.4	28°42'26.6	Loamy soil	45.43n-F	39.22k-B
	Nanu	77°16'13.1	28°49'32.7	Loamy soil	55.63c-x	44.87b-u
			Mean		53.70	43.45
Hathras	Aharai	77°56'45.6	27°31'53.3	Loamy soil	67.39a-f	52.45a-i
	Dayantpur	78°03'37.9	27°37'38.3	Loamy soil	63.42a-k	56.40ab
	Rahna	78°02'14.7	27°39'15.1	Loamy soil	63.84a-j	46.86a-r
	Ruhari	78°03'35.5	27°38'15.8	Loamy soil	64.41a-i	52.32a-j
	Sichawali Sani	78°15'09.9	27°40'30.7	Loamy soil	66.06a-g	50.55a-k
			Mean		65.02	51.84
Kanpur	Amauli	80°10'09.1	26°05'25.8	Sandy loam	55.76c-x	35.13s-D
	Bajpur	80°18'44.1	26°19'29.7	Sandy loam	54.95d-y	47.16a-q
	Bidhnoo	80°16'07.7	26°19'12.7	Sandy loam	54.43d-z	40.10k-A
	Dalelpur	80°17'36.5	26°17'19.4	Sandy loam	58.60a-t	42.58g-x
	Khadesar	80°13'36.4	26°17'25.4	Sandy loam	55.68c-x	47.48a-q
			Mean		56.03	42.49
Kasganj	Afjalpur	78°30'49.6	27°44'34.2	Loamy soil	55.75c-x	50.79a-k
	Barela	78°37'27.2	27°46'06.5	Loamy soil	70.18a-d	49.49a-l
	Mohanpur	78°51'44.5	27°42'52.9	Loamy soil	56.72b-v	44.68c-u
	Daukeli	78°34'51.0	27°53'44.8	Loamy soil	71.61ab	50.78a-k
	Rampur	78°18'10.8	27°21'41.6	Loamy soil	68.48a-e	48.00a-o
			Mean		64.54	48.75
Lucknow	Bani	80°47'56.5	26°39'27.1	Silty clay loam	56.65b-v	47.25a-q
	Belwa	80°45'52.7	26°49'41.3	Silty clay loam	56.54b-v	47.03a-r
	Dona	80°43'16.4	26°49'23.5	Silty loam	58.05a-u	45.35a-t
	Kathigera	80°45'51.4	26°50'23.3	Silty loam	61.87a-m	44.20d-u
	Paliya	80°48'46.3	26°51'31.4	Silty loam	60.91a-o	47.19a-q
			Mean		58.77	46.20
Mathura	Chandrabhan	77°44'45.9	27°18'25.6	Loamy soil	58.04a-u	54.43a-f
	Jait	77°36'06.8	27°34'46.4	Loamy soil	57.12b-u	46.68a-s
	Lohavan	77°43'10.2	27°30'54.7	Loamy soil	60.42a-p	43.49e-x
	Maant	77°42'13.4	27°37'50.7	Loamy soil	58.52a-t	46.37a-s
	Raya	77°47'53.1	27°33'05.4	Loamy soil	61.08a-n	42.98f-x
			Mean		58.99	46.81
Meerut	Aad	77°47'41.4	28°51'57.0	Loamy soil	52.75e-B	36.63n-B
	Ikari	77°34'31.0	29°05'59.2	Loamy soil	49.75h-E	34.56t-D
	Govindpur	77°58'55.6	28°53'41.5	Loamy soil	47.16l-F	36.66n-B
	Mahroli	77°37'33.3	28°55'41.3	Loamy soil	45.75n-F	40.91i-A
	Morna	77°50'07.7	29°00'03.8	Loamy soil	59.04a-r	45.52a-t
			Mean		50.88	38.85
Moradabad	Ahraula	78°55'53.3	28°44'20.2	Loamy soil	65.45a-h	53.25a-g
	Baheri	78°52'25.2	29°01'55.2	Loamy soil	73.57a	54.90a-e
	Baripur	79°58'60.0	27°41'50.2	Loamy soil	64.45a-h	56.22abc
	Hasanganj	78°56'15.2	28°49'39.0	Loamy soil	71.21a-c	55.40ab
	Jaitpur	78°50'27.7	28°53'23.8	Loamy soil	71.32a-c	56.71a
			Mean		69.20	55.29
Prayagraj	Lakhanpur	81°47'03.7	25°24'07.0	Sandy clay loam	44.69p-F	41.68g-z
	Madpur	81°39'33.6	25°28'52.1	Sandy clay loam	52.39f-B	53.05a-h
	Mirapur	81°59'20.7	25°29'39.9	Clay loam	48.98i-E	35.81q-D
	Sairpur	81°43'46.8	25°23'56.9	Sandy clay loam	44.65q-F	39.19k-B
	Tiyara	81°41'18.3	25°23'37.4	Sandy clay loam	48.28j-F	32.06w-D
			Mean		47.79	40.08
Sitapur	Baseti	80°37'27.7	27°42'02.1	Silty loam	47.72I-F	38.81I-B
	Dalel Nagar	80°36'41.3	27°29'24.8	Silty loam	43.37r-F	38.75I-B
	Hathia	80°33'29.8	27°38'46.7	Silty loam	44.92 p-F	41.47h-Z

Hempur	80°34'18.8	27°37'14.3	Silty loam	51.55f-D	39.59k-A
Jhariya	80°40'51.6	27°45'16.4	Silty loam	49.01i-E	43.25e-x
		Mean		47.30	40.37

\*Average of five replicates

The maximum incidence and severity was noted in Moradabad followed by Hathras, Kasganj, Mathura, and Lucknow. While, minimum incidence and severity was recorded in Agra. The similar results were also found by Bharti *et al.* [14] who conducted a survey in different parts of Uttar Pradesh, and found that the crop grown at Kanpur, Varanasi, and Jaunpur was severely affected with *Alternaria* blight disease and observed the maximum disease intensity (53.60%) from Kalyanpur (Kanpur) and lowest intensity (37.60%) was recorded from Bagha (Kanpur) during their survey of various locations. Gupta *et al.* [15] found maximum disease intensity (44.13%) at Chatha, while minimum disease intensity (28.90%) was recorded from the Gudwal area of Jammu Province. Variation in *Alternaria* blight incidence and severity of rapeseed-mustard at different locations might be due to inappropriate cultural practices like closer spacing, frequent irrigations, sowing dates, heavy fertilization, and common management practices of crop *vis-à-vis* disease development [16]. Prevailing low temperature, high relative humidity, dry weather, and splashing rain during winter in Moradabad and Kasganj district might be the reason for the enhanced severity of *Alternaria* blight. This disease has been reported to be predominantly seed-borne [17]. So, it seems that the prevalence

of the disease in *Alternaria* blight affected areas might be due to the continuous use of local infected seed that has not been replaced for several years and inappropriate management strategies adopted at suitable stages along with improper cropping practices being followed by the farmers [18]. Favourable environmental conditions, soil texture and use of susceptible varieties might also be the other factors that enhanced the incidence of this disease in these locations.

## CONCLUSION

The prevalence of *Alternaria* blight in rapeseed-mustard varied significantly in different locations of Uttar Pradesh. Maximum incidence and severity were noted in district Moradabad followed by Hathras, Kasganj, Mathura, Lucknow, Bijnor, Budaun, Kanpur, Ghaziabad, Meerut, Etah, Prayagraj, Bareilly, Sitapur, Aligarh, Bulandshahr, Etawah, Ayodhya, Gautam Buddha Nagar and Agra. This variation might be due to prevailing environmental conditions and continuous cultivation of susceptible varieties by the farmers over the years in these locations. The study highlights on looking for new resistance sources under field conditions and encouraging the use of resistant cultivars against this disease.

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