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First Report on Severity of Early Blight Disease of Tomato Caused by *Alternaria alternata* in *Hadoti* Region of Rajasthan

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ABSTRACT: Early blight, being the most devastating disease of tomato (*Solanum lycopersicum* L.) is considered to be a great threat to its production world widely. This disease is caused by several species of Alternaria and has been observed in all districts of *Hadoti* region of Rajasthan namely Kota, Bundi, Baran and Jhalawar. Assessment of disease severity is an important step as it helps in designing management strategies which ultimately help in increasing the crop yield. Therefore, a roving survey was conducted to find out the disease severity of tomato blightin foresaid region. The disease was prevalent in all the tomato growing areas during *rabi* 2019-2020. Percent disease index (PDI) was recorded to be highest in Kota district (44.06 %) followed by Baran, Bundi and Jhalawar (38.08 %) irrespective of cultivars grown. Charchoma village of Kota district recorded highest PDI (49.98 %) while, lowest PDI was recorded in Azampur village of Jhalawar district (34.34). Further, the pathogenic species was identified as *Alternaria alternata*. To our best knowledge, this is first report on severity of early blight disease of tomato in *Hadoti* region of Rajasthan.

Keywords: Early blight, Tomato, *Alternaria* spp., Survey, Percent disease index.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) belongs to the family Solanaceae and is native from Peruvian and South American region. It is one of the most remunerable and widely grown vegetables across the globe. Among the vegetables, tomato ranks next to potato in world acreage and first among the processing crops. In India, it is grown all over from north to south and east to west. Thus, India ranks second position in total world production of tomato after China (FAOSTAT, 2017). In Rajasthan state, tomato crop is grown over an area of 18.12 thousand hectares and with an annual production of 88.73 MT during 2017-18 (Anonymous, 2019). However, commercial production of this crop is arrested due to several biotic and abiotic factors. Intense selection and inbreeding during evolution and domestication of this crop resulted in narrow genetic diversity, thus making the crop more prone to diseases caused by bacteria, fungi, virus and nematodes which adversely affect the production as well as quality of the produce at large (Zhang *et al*., 2002).

Early blight disease of tomato is one of the most wide spread and exterminatory disease occurring worldwide in major tomato growing area (Akhtar *et al.,* 1994). It is caused by several species of Alternaria including *Alternaria solani*, *A. tomatophila* as well as *A. alternata* (Adhikari *et al.,* 2017). Recently, *Curvularia lunata* has been established as one of the pathogens of early blight disease of tomato in Egypt which was showing 99-100% nucleotide identity with *Alternaria solani* and *A. alternate* (Abdelfatah *et al*., 2021). The disease can be identified by characteristics symptoms which appear first on older leaves of lower part and then after, move above towards younger tissue (Agrios, 2005). Initial symptoms develop as dark brown to black spots which enlarge in size and prominent concentric rings appear after sporulation which forms typical "target board'' symptoms orbull eye shaped spots, as a result of sporulation pattern. Infection can be seen on all plant parts *i.e*., on stem, twigs, leaves, fruit etc. Under suitable environment conditions, Alternaria causes defoliation, drying off of twigs and premature fruit drop and thus causing losses up to 79 per cent in fruit yield (Adhikari *et al.,* 2017; Tanvir *et al*., 2020).

This disease has been noticed in tomato growing area of *Hadoti*region of Rajasthan and speculated as major reason behind low productivity. Assessing disease severity is the first step in designing management strategies against any disease. Since there is no report regarding severity and causal agent of early blight disease of tomato in this region, current study aimed to enumerate the disease severity and to find out the pathogen associated with the disease in *Hadoti* region.

MATERIAL AND METHODS

An extensive survey was conducted during*rabi* 2019-20 in four tomato growing districts of *Hadoti* region of Rajasthan *viz*., Kota, Bundi, Baran and Jhalawar to know the disease severity of early blight disease of tomato.

Four/five villages from each district were selected where tomato was under cultivation. In each village, four fields were selected randomly for recording the

data and PDI was calculated by using the formula mentioned under here.

Percent Disease Index (PDI): Leaf samples showing typical target board symptoms were collected and brought to the laboratory for isolation of pathogen. Pathogen was isolated and pure culture was obtained by tissue isolation followed by single spore isolation respectively. Pathogen was identified based on cultural and morphological characters and pathogenic species was confirmed from Department of Plant Pathology, IARI, New Delhi.

$$PDI = \frac{\text{Sum of individual disease ratings}}{\text{Total number of leaves examined} \times \text{Maximum number of disease rating}} \times 100$$

Disease severity was measured by using 0-5 scale with modification described by Pandey *et al*. (2003)

Rating	Reaction description
0	Free from infection
1	One or two necrotic spots on few lower leaves of plant, covering nearly 1-10% surface area of plant
2	A few isolated spots on leaves covering 11-25% surface area of plant
3	Many spots coalesced on the leaves covering 26-50% of the surface area of the plants
4	Concentric rings on the stem petiole, fruit covering 51-75% leaf area of plant
5	Whole plant blighted leaf and fruits starting to fall covering more than 75% leaf area of the plant

RESULTS AND DISCUSSION

A roving survey was carried out to find out the severity of early blight disease of tomato in districts of *Hadoti* region of Rajasthan *viz*., Kota, Baran, Bundi and Jhalawar during *rabi* 2019-20. Four villages were selected from each district and data were recorded on disease severity. The results are presented in Table 1 and Fig. 1 & 2 revealed that percent disease index (PDI) ranged from 34.34 to 49.98 percent in all surveyed villages. Alternaria blight disease was found more severe in Kota district of Rajasthan. The highest PDI of 49.98 per cent was recorded in Charchoma village of Kota district followed by Kundanpur village of same district (48.67%), whereas, minimum percent disease index (34.34%) was observed in Azampur village of Jhalawar district followed by Garwara village of same district (36.73%). Among the districts (Fig. 2), maximum mean percent disease index was observed in Kota (44.06), followed by Baran (42.85 %). While least percent disease index was recorded in Jhalawar with a PDI of 38.08 percent followed by Bundi district (41.93%).

Table 1: Percent disease index (PDI) of early blight disease of tomato caused by *Alternaria alternata* in *Hadoti* region of Rajasthan during *rabi* 2019-2020.

S. No.	Name of village	Name of growing varieties (As per farmers)	Percent disease index(PDI)	Area (Hectare)	Mean PDI of each village
District = Kota					
1.	Charchoma	Kareena Namdhari-5018 Pusa-5000 Meghdhoot	50.33 49.67 48.77 51.16	0.60 0.80 0.40 0.80	49.98
2.	Jalkhera	Himshikhar Kareena Namdhari-5018 Rakshak	42.33 40.17 39.77 38.36	0.80 1.00 0.50 1.25	40.16
3.	Sangod	Himshikhar Rakshak Tomato-1057 Abhilas	46.71 40.66 42.33 39.67	1.01 0.80 1.21 0.60	42.20
4.	Kundanpur	Namdhari-5018 Rakshak Himshikar Lakshmi	49.24 47.33 52.67 45.47	0.20 0.80 0.20 1.21	48.67
5.	Galana	Rakshak Namdhari-5018 Tomato- 1057 Rakshak	42.67 38.33 36.17 40.00	1.01 0.60 0.80	39.29
Average PDI of Kota district					**44.06**

District = Baran					
1.	Siswali	Himshikhar Namdhari-5018 Tomato-1507 Abhinav	45.34 42.55 45.67 35.77	1.41 0.60 1.01 1.21	42.33
2.	Barsat	Pusa-4000 Himshona Rakshak Pusa-5000	48.67 46.33 41.33 45.00	0.40 1.61 0.60 0.80	45.33
3.	Utawali	Sona Himshikhar Laxami-5005 Pusa-4000	41.77 40.33 38.67 37.33	0.80 0.60 0.80 0.40	39.52
4.	Mangrol	Pusa-5000 Laxami Himsona Namdhari-5018	46.67 47.67 39.17 43.33	1.21 0.40 1.21 0.60	44.20
Average PDI of Baran district					**42.85**
District = Bundi					
1.	Sawar	Pusa-4000 Tomato-2853 Laxami-5005 Himshikhar	45.67 38.33 42.77 47.77	0.80 0.80 1.01 0.80	43.44
2.	Vinayaka	Himshikhar Pusa-4000 Himshikhar Krishna	38.38 36.67 43.17 39.33	1.21 1.61 0.80 0.80	40.12
3.	Bhargaon	Rakshak Meghdoot Pusa-4000 Himshikhar	47.38 46.00 42.33 45.67	0.40 1.01 1.21 1.01	44.34
4.	Mehrana	Himshikhar Namdhari-5018 Abhinav Krishana	37.46 35.67 40.77 42.47	1.01 0.80 1.61 0.80	38.84
Average PDI of Bundi district					**41.68**
District = Jhalawar					
1.	Azampur	Karishna Tomato-1057 Laxami-5005 Abhinav	34.77 30.66 37.17 34.00	1.21 1.01 1.01 0.80	34.34
2.	Dobri	Himshikhar Karishna Namdhari-5018 Laxami-5005	41.66 40.67 39.33 47.44	0.20 0.80 0.20 1.01	41.25
3.	Garwara	Namdhari-5018 Himshikhar Namdhari- 5018 Laxami-5005	39.60 40.33 36.67 30.33	0.80 0.80 1.01 0.80	36.73
4.	Semlikham	Laxami-5005 Rakshak Abhinav Tomato-1057	40.17 37.77 42.77 39.33	1.01 0.80 1.61 0.20	40.01
Average PDI of Jhalawar district					**38.08**

In Baran district, percent disease index varied from 39.52 to 45.33 per cent. Maximum PDI was observed in Barsat village (45.33%), followed by Mangrol village (44.20%). However, least percent disease index of 39.52 per cent was recorded in Utawali village followed by Siswali (42.33%). Among the villages of Bundi district, maximum percent disease index was recorded in Bhargaon (44.34%) which was followed by Sawar (43.44%). Meharana village showed least disease with a PDI of 38.84 per cent, followed by Vinayaka village (40.12%). In Jhalawar district, Dodri village showed maximum percent disease index (41.25%) among the villages, while least percent disease index (34.34) was recorded from Azampur village followed by Garwara village (36.73%).

Pathogen was isolated from the samples collected during survey and pure culture was obtained as mentioned in material and methods. Study on morphological and cultural characteristics revealed that the pathogen was *Alternaria alternate* which was further confirmed from Department of Plant Pathology, IARI, New Delhi (ID NO.11, 291.20.).

Early blight disease of tomato was prevalent in all surveyed areas with PDI ranged from 34.34 to 49.98 per cent. High levels of disease severity may be attributed to presence of *Alternaria alternate* species in this region, as confirmed in present study. *A. alternata* has been reported earlier to have more pathogenicity than the other species of Alternaria (Ramezani *et al.*, 2019). Disease severity was found to be highest in Kota district which may be due to the pathogenicity variability of the isolates of *A. alternata*. Habibullah *et al*., (2020) showed that isolates of Alternaria from different regions exhibited a range of virulence in Pakistan. Variation in disease occurrence may be due to different varieties grown by the farmers, variation in virulence of the isolates of pathogen, inoculum potential of pathogen, availability of inoculum and abiotic factors like environmental conditions. Present findings are in accordance with findings of Abhinandan *et al.*, (2004), Kamble *et al.*, (2009), Kumar *et al.*, (2013), Soni *et al.*, (2017), Krishna *et al*., (2017) and Sharma *et al.*, (2019). This study call attention to the need of integrated disease management strategy for minimizing the losses due to early blight disease of tomato in *Hadoti* region for ensuring high yield of crop and wellbeing of farmers community.

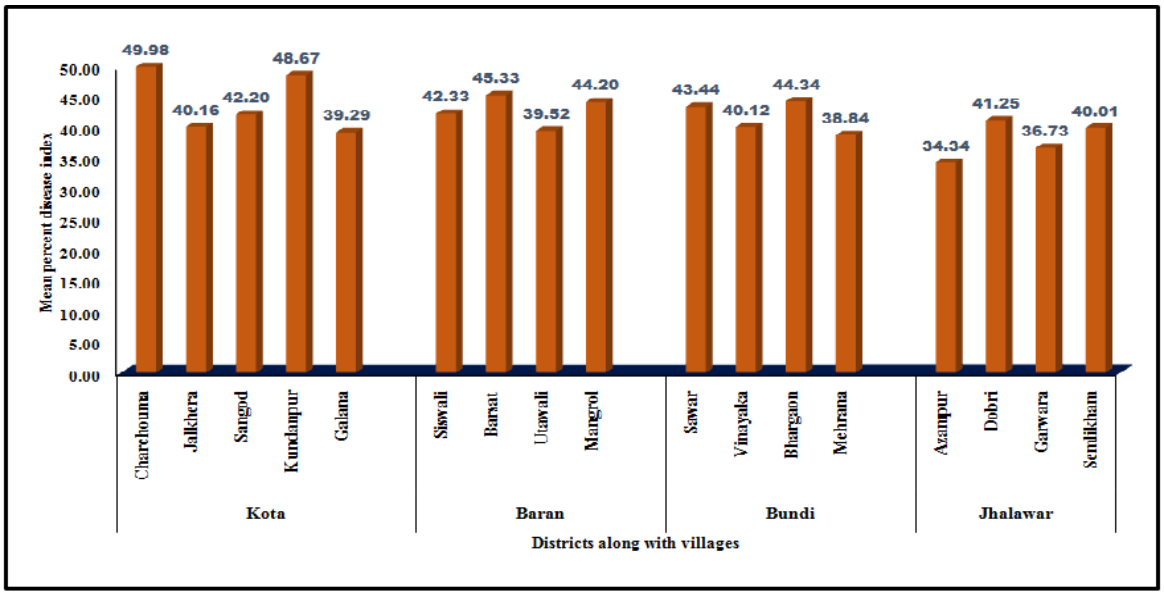

Fig. 1. Percent disease index (PDI) of early blight disease of tomato caused by *Alternaria alternata* in *Hadoti* region of Rajasthan during *rabi* 2019-2020.

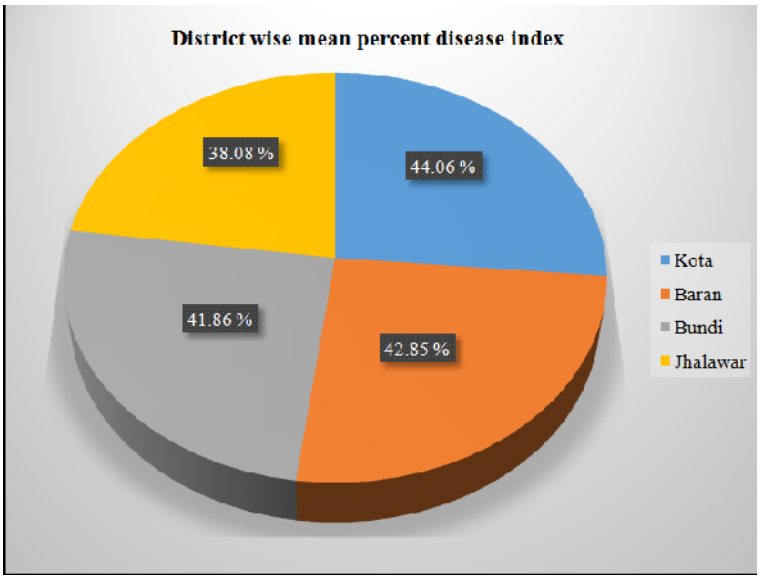

Fig. 2. District wise mean disease index of early blight disease of tomato caused by *Alternaria alternata* in *Hadoti* region of Rajasthan during *rabi* 2019-2020.

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