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Pathogenic variability among different isolates of *Alternaria solani*, causing early blight disease of tomato

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Abstract

Among the fungal diseases infecting tomato crops, early blight caused by *Alternaria solani* (Ellis and Martin) Jones and Grout is one of the most catastrophic disease causing accountable losses. Further, all of the tomato cultivars presently under cultivation have succumb more or less to early blight disease. Therefore, the present studies were undertaken for the pathogenic variability, the twelve isolates were recorded significant variation in per cent disease intensity (11.85- 78.21%) at 60 DAS and (19.92- 89.10%) at 90 DAS. Under pot conditions isolate Aljp-2 was found highly pathogenic among all isolates and recorded highest per cent disease intensity. Lowest per cent disease intensity was observed by Altk-8 isolate in both the conditions of observations.

Keywords: *Alternaria solani*, PDI and pathogenic variability

Introduction

Tomato (*Lycopersicon esculantum* Mill.) is the second most important vegetable crop after potato, which belongs to the family *solanaceae*. Tomato is a native to Peruvian and Mexican region. It is a well-known fact that tomato is a main fruit consumed as a vegetable globally which provides important minerals, vitamins, fibres and antioxidants. Tomato is grown for its edible fruits, which can be consumed either fresh or in the form of various processed products. Tomato has high medicinal value, its pulp and juice is digestible promoter of gastric secretion and blood purifier. China is the leading country in production of tomato (31%), followed by India and the United States with the second and third highest producer in the world. The consumption of tomato stands second after potato being rich in vitamins (K, C and A), minerals (Fe, Ca and P), amino acids, sugars, dietary fibres and antioxidant and contains 95.3% of water [Gomes *et al*, 2010, Awan *et al.*, 2019,] ^[5, 3]. In India tomato production is 21055.85 million tonnes and area 865.29 Million ha (Anonymous 2021,) ^[1]. In Rajasthan, It occupied an area of 20.50 Million ha with an annual production of 232.86Mt (Anonymous 2021) ^[1]. Tomato plants are suffered with large number of biotic stresses including insect pests and diseases from the time of emergence to harvest. It suffers with various diseases incited by fungi, bacteria, viruses, nematodes etc. in several countries (Mark and Brooke 2006) ^[7]. It is highly sensitive to abiotic stresses especially extreme temperature, salinity, drought, excessive moisture and environmental pollution and biotic stresses. More than 200 diseases have been reported to infect tomato in the world (Atherton and Rudich, 1986) ^[2]. Large number of fungal diseases such as Alternaria blight (*Alternaria alternata*), Early blight (*Alternaria solani*), Late blight (*Phytophthora infestans*), Septoria leaf blight (*Septoria lycopersici*), Powdery mildew (*Oidiopsis taurica*), Fusarium wilt (*Fusarium oxysporum f. sp. lycopersici*), Collar rot (*Sclerotium rolfsii*), and Damping off (*Pythium sp.*) are causes severe losses in tomato. Among the fungal diseases, early blight caused by *Alternaria solani* is one of the most important and frequent occurring disease of the crop nation and worldwide (Jones *et al.*, 1993). Among the fungal diseases, early blight also known as target spot disease incited by *Alternaria solani*. It is very difficult to manage Alternaria blight because the pathogen has wide host range, extreme variability in pathogenic isolates and prolonged active phase of the disease cycle. The causal organism is air borne and soil inhabiting and is responsible for early blight, collar rot and fruit rot of tomato (Datar and Mayee, 1981) ^[4]. In India it causes about 72% of total production loss every year and about 1.36% of yield loss every year (Gomes *et al.*, 2010) ^[5].

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Material and Methods

Pathogenic Variability

Pathogenic variability of *Alternaria solani* isolates was studied by inoculating these isolates on susceptible cultivar S-22 in pots in cage house. Thirty days old plants was sprayed with spore suspension (1×10^5 spores /ml) and observed per cent disease intensity (PDI) was observed at 60 and 90 DAS as per formula of (Wheeler, 1969)^[9].

$$\text{PDI} = \frac{\text{Sum of numerical disease rating}}{\text{No. of fruits /leaves assessed} \times \text{Maximum disease rating}} \times 100$$

*PDI= Per cent Disease Intensity

Result and Discussion

Pathogenic variability among different isolates of early blight of tomato pathogen was tested under pot conditions. All isolates were tested on susceptible cultivar S-22. The PDI was observed as at 60 DAS which followed the sequence of descending order as Aljp-2 (78.21%), Alsk-5 (66.98%), Aljp-1 (64.52%), Alsk-6 (52.41%), Aljp-3 (46.62%), Alsk-4

(31.54%), Alds-11 (30.54%), Altk-9 (24.95%), Altk-7 (23.47%), Alds-10 (21.16%), Alds-12 (12.85%) and Altk-8 (11.85%). Isolate Aljp-2 (89.10%) was highly virulent followed by isolates Aljp-1 (75.62%), Alsk-5 (74.22%), Alsk-6 (64.85%), Aljp-3 (55.19%), Alds-11 (42.13%), Alsk-4 (38.18%), Altk-9 (34.62%), Altk-7 (32.22%), Alds-10 (31.15%), Alds-12 (20.84%) and Altk-8 (19.92%) at 90 DAS. The result revealed that all the twelve isolates also recorded significant variation in per cent disease intensity (11.85-78.21%) at 60 DAS and (19.92-89.10%) at 90 DAS. Under pot conditions isolate Aljp-2 was found highly pathogenic among all isolates and recorded highest per cent disease intensity. Lowest per cent disease intensity was observed by Altk-8 isolate in both the conditions of observations. Rahmatzai *et al.* (2016)^[8] reveal that the isolate AS1 of *A. solani* was most virulent with maximum level of disease incidence (53.5%) and disease severity (32.00%), whereas, in case of the AS2 isolate noted the least early blight incidence of 27.00% and disease severity of 18.00% was recorded. AS1 isolate produced properly clear blight symptoms on leaves, stem and even fruits and was found to be virulent causing severe disease in tomato plants.

Table 1: Pathogenic variability among different isolates of *Alternaria solani*

S. No.	Isolates	% Disease Intensity (PDI) *	
		60 DAS	90 DAS
1	Aljp-01	64.52	75.62
		(53.44)	(60.41)
2	Aljp-02	78.21	89.10
		(62.17)	(70.72)
3	Aljp-03	46.62	55.19
		(43.06)	(47.98)
4	Alsk-04	31.54	38.18
		(34.17)	(38.16)
5	Alsk-05	66.98	74.22
		(54.93)	(59.49)
6	Alsk-06	52.41	64.85
		(46.38)	(53.64)
7	Altk-07	23.47	32.22
		(28.98)	(34.58)
8	Altk-08	11.85	19.92
		(20.14)	(26.51)
9	Altk-09	24.95	34.62
		(29.97)	(36.04)
10	Alds-10	21.16	31.15
		(27.39)	(33.93)
11	Alds-11	30.54	42.13
		(33.55)	(40.47)
12	Alds-12	12.85	20.84
		(21.01)	(27.16)
	S.Em±	0.89	1.13
	CD (P=0.05)	2.56	3.24
	C.V.	4.69	5.11

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