

Original Research Article

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Severity of *Alternaria* Leaf Spot of Brinjal caused by *Alternaria alternata* in Kashmir, India

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ABSTRACT

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Alternaria leaf spot caused by *Alternaria alternata* is one of the important foliar diseases of brinjal (*Solanum melongena* L.) The present study on severity of *Alternaria* leaf spot of brinjal in Kashmir valley was conducted during kharif 2016. An extensive survey was conducted in three districts of Kashmir valley viz., Anantnag, Baramulla, and Budgam revealed that disease was prevalent in all the three districts with mean disease incidence and intensity of 30.76 and 9.77 per cent, respectively. The maximum disease incidence of 38.68 and intensity of 14.07 per cent was observed in district Budgam and minimum disease incidence of 21.73 and intensity of 5.88 per cent was observed in district Anantnag.

Introduction

Brinjal (*Solanum melongena* L.) or egg-plant belonging to family Solanaceae, is believed to have originated from India (Zeven and Zhukovsky, 1975) and many species of this plant still grow as wild in this country. Brinjal is also a popular vegetable in China, Japan, Egypt, Italy, USA, Syria, Philippines, Thailand, Indonesia, France, and Turkey (Beura *et al.*, 2008). In India, it is grown throughout the country round the year except in Jammu and Kashmir State where it is only a Kharif season crop. The total area under brinjal cultivation in the world is 1864.32 thousand hectares with annual production and

productivity of 49782.16 thousand Metric Tonnes and 26.70 MT per hectare respectively (Anonymous, 2015a). In India it is cultivated over an area of 711.30 thousand hectares with an annual production of 13557.81 thousand MT and productivity of 19.1 MT per hectare wherein, Jammu and Kashmir covered the cultivated area of 2.02 thousand hectares with an annual production of 45.24 thousand MT and productivity of 22.39 tonnes per hectare (Anonymous, 2015b). Egg plants are a very good source of protein and dietary fiber. The fruits are also rich in potassium, manganese, copper, vitamin B1, vitamin B6, foliate, magnesium, and niacin (Aykroyd, 1963). Brinjal crop is attacked by number of fungal,

bacterial, viral and phytoplasmal diseases like Alternaria leaf spot (*Alternaria alternata* (Fr.) Keissler), Damping off (*Pythium aphanidermatum* (Eds.) fitz.; *Phytophthora spp.*; *Rhizoctonia spp.*), Phomopsis blight (*Phomopsis vexans* Sacc. and Syd.) Harter, Cercospora leaf spot (*Cercosporasolani melongenae* Chupp. *C. solani*.), Verticillium wilt (*Verticillium dahliae* Kleb), Fusarium wilt (*Fusarium solani* (Mart.) App and Wollenw), Bacterial wilt (*Ralstonia solanacearum* Smith), Little leaf (Phytoplasma.), Mosaic virus, Root-knot nematodes (*Meloidogyne javanica* (Treb) Chitwood) during various growth stages which reduce its yield and quality of fruits. The Genus *Alternaria* Nees. Ex Fr. belongs to the sub-division Deuteromycotina, class Hyphomycetes, family Dematiaceae (Woudenberg *et al.*, 2013).

The genus is widely distributed all over the world. The fungus grows and sporulates on plant debris during periods of rain, heavy dew, or under good moisture conditions. This disease is severe and appears regularly, causing heavy losses in yield. Balai and Ahir (2013) reported upto 25% yield losses from Jaipur district due to leaf spot of brinjal. The disease first makes its appearance in young seedling. It attacks leaves and then spreads to fruits which subsequently rot and become unfit for consumption (Bochalya *et al.*, 2012). Initially disease appears as small, dark brown and sunken spots, which subsequently gets converted into concentric rings and then become olivaceous dark brown lesion due to spore formation.

Materials and Methods

The present investigations on the status of Alternaria leaf spot of brinjal was undertaken in three districts located from north to the south of Kashmir valley at 1580 meters to 2000 meters (amsl) were surveyed to assess the disease incidence and intensity. The details

of materials and methodologies followed during the course of investigation are described here under:

Survey for disease status

Field survey of commercially important vegetable growing belts in the districts of Anantnag, Budgam and Baramulla was carried out during the month July – August 2016. Each district was represented by three locations and each location by three sites. Mean of three fields represented disease incidence and intensity of respective site. Nine plants each at four corners and centre of the fields were randomly selected and their leaves were examined for recording disease incidence and disease intensity.

Per cent disease incidence and intensity was calculated by using the following formula:

Per cent disease incidence was calculated as per the formula:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected leaves}}{\text{Total Number of leaves examined}} \times 100$$

The disease intensity was recorded using 0-5 scale (Pandey and Pandey, 2001) with slight modifications. Six categories were made on the basis of per cent leaf involved (Plate 1) as per the following key:

Per cent disease intensity (PDI) was calculated as per the following formula:

$$\text{Per cent disease intensity} = \frac{\sum (n \times v)}{N \times S} \times 100$$

Where,

\sum = Summation

n = Number of diseased leaves in each category

v = Numerical value of the category

N = Total number of leaves examined, and

S = Maximum numerical rating

Results and Discussion

With a view to find out the status of *Alternaria* leaf spot of brinjal in Kashmir valley, the survey was carried out in three districts viz., Anantnag, Budgam, and Baramulla of Kashmir valley for the prevalence of *Alternaria* leaf spot of brinjal during kharif 2016. The data on disease incidence and intensity recorded are presented in Table 1 and 2.

Disease incidence

The data presented in Table 1 revealed that *Alternaria* leaf spot of brinjal was prevalent in all the sites of districts surveyed with varying levels of incidence ranging from 17.82 per cent to 45.86 per cent. The highest disease incidence was recorded in district Budgam (38.68%) followed by district Baramulla

(31.89%) while as the district Anantnag (21.37%) exhibited the least disease incidence. The disease incidence ranged from 17.82 to 25.78 per cent in district Anantnag, whereas in Baramulla from 29.42 to 37.64 per cent and in Budgam it ranged from 33.86 to 45.86 per cent. Among the locations surveyed highest disease incidence of 43.21 per cent was recorded in chadoora followed by Khansahib (36.76%), lowest disease incidence was recorded in Shahbad (20.70%). On an overall comparison amongst different sites surveyed, the highest disease incidence of 45.86 per cent was recorded in Qaisarmulla followed by Bugam (42.87%) and Nowbugh (40.89%). The least disease incidence of 17.82 per cent was recorded in Shangrin. Statistical analysis of the surveyed data revealed that the limits for average disease incidence fluctuated between 18.78 to 24.61 per cent for Anantnag district and 29.92 to 33.59 per cent for Baramulla district. Similarly, for Budgam district the limits fluctuated between 36.55 to 40.77 per cent respectively. However, the average statistical limits in all the three districts at all the locations in incidence fluctuated between 28.41 to 32.99 per cent.

Survey for disease status

S. No.	Name of District	No. of Locations	No. of sites per location	Total sites
1.	Anantnag	03	03	09
2.	Baramulla	03	03	09
3.	Budgam	03	03	09
Total	03	09	09	27

The disease intensity

Category	Grade	Criteria (% diseased leaf area covered)
I.	0	No infection/ disease
II.	01	0.1- 10.0
III.	02	10.1-25.0
IV.	03	25.1-50.0
V.	04	50.1-75.0
VI.	05	75.1-100

Table.1 Incidence of *Alternaria* leaf spot of brinjal in various locations of Kashmir valley during 2016

District	Location	Site	Per cent Disease Incidence	95% C.I. **	
				Lower limit	Upper limit
Anantnag	Ahabal	Haji Dantar	25.78*	19.82	25.78
		UttarsooNajigund	20.83		
		Lalan	21.83		
		Sub Mean	22.83		
	Breng	Sagam	21.27	19.42	37.92
		Larnoo	19.98		
		HilarArhama	23.72		
		Sub Mean	21.66		
	Shahbad	Larkipora	20.12	17.11	24.29
		Shangrin	17.82		
		Mehmooabad	24.18		
		Sub Mean	20.70		
Overall mean			21.73	18.78	24.61
Baramulla	Sopore	Arapora	37.64	32.28	37.92
		Chinkipora	35.12		
		Wadura	32.64		
		Sub Mean	35.13		
	Pattan	Palhalan	30.72	29.47	31.27
		Wusan	29.66		
		Nehalpora	31.66		
		Sub Mean	30.68		
	Baramulla	Stadiumcolony	31.66	28.01	38.52
		Johama	28.52		
		Chakla	29.42		
		Sub Mean	29.87		
Overall mean			31.89	29.92	33.59
Budgam	Khansahib	Kremshore	37.54	35.73	29.92
		Khansahib	36.89		
		Wager	35.86		
		Sub Mean	36.76		
	Chadoora	Bugam	42.87	40.26	46.14
		Qaisarmulla	45.86		
		Nowbugh	40.89		
		Mean	43.21		
	Mazhama	Kuthipora	33.86	33.66	38.52
		Kawoosa	36.31		
		Dawlatpora	38.09		
		Sub Mean	36.09		
Overall mean			38.68	36.55	40.77
Overall disease incidence			30.76	28.41	32.99

*Average of three fields at each site.

** C.I. = Confidence Interval

Table.2 Intensity of *Alternaria* leaf spot of brinjal in various locations in the Kashmir valley during 2016

District	Location	Site	Disease Intensity (%)	95% C.I.**	
				Lower limit	Upper limit
Anantnag	Anantnag	Haji Dantar	6.40*	5.57	7.03
		UttarsooNajigund	5.60		
		Lalan	6.92		
		Sub Mean	6.31		
	Brenag	Sagam	5.62	4.91	6.49
		Larnoo	5.13		
		HilarArhama	6.53		
		Sub Mean	5.76		
	Shahbad	Larkipora	6.13	4.91	6.08
		Shangrin	5.05		
		Mehmooabad	5.57		
		Sub Mean	5.58		
	Overall mean			5.88	5.13
Baramulla	Sopore	Arapora	12.19	9.86	12.13
		Chinkipora	10.13		
		Wadura	10.73		
		Sub Mean	11.01		
	Pattan	Palhalan	9.41	8.08	10.57
		Wusan	10.32		
		Nehalpora	8.15		
		Sub Mean	9.29		
	Baramulla	Stadiumcolony	8.99	6.68	8.92
		Johama	7.01		
		Chakla	7.42		
		Sub Mean	7.81		
	Overall mean			9.37	8.20
Budgam	Khansahib	Kremshore	14.18	11.29	8.20
		Khansahib	12.17		
		Wager	11.82		
		Sub Mean	12.72		
	Chadoora	Bugam	15.86	14.52	16.86
		Qaisarmulla	16.82		
		Nowbugh	14.69		
		Sub Mean	15.79		
	Mazhama	Kuthipora	13.32	13.41	14.20
		Kawoosa	14.13		
		Dawlatpora	13.82		
		Sub Mean	13.70		
	Overall mean			14.07	12.72
Overall disease intensity			9.77	8.80	10.70

*Average of three fields at each site.

** C.I. = Confidence Interval

Disease intensity

The data presented in Table 2 revealed that *Alternaria* leaf spot of brinjal was prevalent in all the sites of districts surveyed with varying levels of intensity ranging from 5.05 per cent to 16.82 per cent. The highest disease intensity was recorded in district Budgam (14.07%) followed by district Baramulla (9.37%) while as the district Anantnag (5.58%) exhibited the least disease incidence. The disease intensity ranged from 5.05 to 6.92 per cent in district Anantnag, whereas in Baramulla from 7.01 to 12.19 per cent and in Budgam it ranged from 11.82 to 16.82 per cent. Among the locations surveyed highest disease intensity of 15.79 per cent was recorded in Chadoora followed by Khansahib (12.72%), lowest disease intensity of 5.58 per cent was recorded in Shahbad. On an overall comparison amongst different sites surveyed, the highest disease intensity of 16.82 per cent was recorded in Qaisarmulla followed by Bugam (15.86%) and Nowbugh (14.69%). The least disease intensity of 5.05 per cent was recorded in Shangrin. Statistical analysis of the surveyed data revealed that the limits for average disease intensity fluctuated between 5.13 to 6.53 per cent for Anantnag district and 8.20 to 10.54 per cent for Baramulla district. Similarly, for Budgam district the limits fluctuated between 12.72 to 15.42 per cent respectively. However, the average statistical limits in all the three districts at all the locations in intensity fluctuated between 8.80 to 10.70 per cent.

Brinjal (*Solanum melongena* L.) is a major solanaceous vegetable crop of India after tomato and potato. Plant diseases are greatest constraints in commercial crop cultivation and always upset our calculations of crop production and crop protection. Evidently, our most component of Indian vegetarian diet-brinjal or egg-plant cultivation also faces serious economic threat due to various

diseases. Among all *Alternaria* leaf spot caused by *Alternaria alternata* (Fr.) Keissler is an important foliar disease observed in severe form since last few years. Establishing the disease status is pre-requisite to decide the adoption of management strategies. In the present study, survey conducted in three districts of Kashmir valley during kharif 2016 indicated that *Alternaria* leaf spot of brinjal was more or less prevalent in all the locations of the districts. The average disease incidence was highest (38.68%) in district Budgam followed by district Baramulla (31.89%) and Anantnag (21.73%). The disease incidence at various locations revealed that maximum disease incidence was recorded at Chadoora (43.21%) followed by Khansahib (36.76%) while lowest disease incidence was recorded in Shahbad (20.70%). Among the different sites surveyed highest disease incidence was recorded at Qaisarmulla (45.86 %) followed by Bugam (42.87%) and Nowbugh (40.89%) areas of district Budgam, while as the lowest disease incidence was recorded at Shangrin (17.82%) site of district Anantnag. Results about the disease intensity revealed that district Budgam (14.07%) was having highest disease intensity followed by Baramulla (9.37%) while as lowest disease intensity was recorded in Anantnag (5.88%). On comparing different locations it was observed that highest disease intensity was found in Chadoora (15.79%) while as lowest intensity was observed in Shahbad (5.59%). Among the different sites surveyed highest disease intensity was recorded at Qaisarmulla (16.82%) followed by Bugam (15.86%) and Nowbugh (14.69%) areas of district Budgam, while as the lowest disease intensity was recorded at Shangrin (5.05%) site of district Anantnag. The survey results are well supported with that of Balai and Ahir (2013), they observed 25.32 per cent intensity when surveyed on leaf spot disease of brinjal caused by *Alternaria alternate* in Jaipur district of Rajasthan. Premila (2014) recorded 9.5 to

29.5 per cent incidence of leaf spot disease on brinjal in Manipur. Similar results about the prevalence of the disease have also been reported by Balai *et al.*, (2010).

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