To study the status of Alternaria leaf blotch on Apple under Kashmir conditions

ABSTRACT

Alternarialeaf blotch (*Alternaria mali*Roberts) of apple is one of the major fungal diseases in all the apple growing regions of the world. Although the disease was previously of minor economic importance in Kashmir valley, it has now attained the status of one of the major diseases of apple.The frequent epidemics of Alternaria leaf blotch have been witnessed in Kashmir, inflicting heavy losses. As most of the commercial apple cultivars are susceptible to this disease, orchardists mainly rely on frequent fungicide applications for its management .Four districts of the valley viz., Pulwama, Kulgam, Shopian and Srinagar were surveyed to record the status of Alternaria leaf blotch disease of apple. The disease was prevalent in all the districts surveyed with an overall disease incidence and intensity 55.59 and 33.16,respectively. Highest disease incidence and intensity was recorded in district Kulgam and least in district Shopian.

Keywords:Disease incidence, intensity , Alternaria leaf blotch , survey

1. Introduction

Apple is a rosaceous fruit tree, belonging to the genus *Malus*, holds a preeminent position as the most extensively cultivated fruit tree globally. Thriving primarily in temperate regions across the northern and southern hemispheres, its economic significance is profound. China emerges as the foremost cultivator of apples, boasting the largest area under cultivation at 2.4 million hectares and the highest fruit production, reaching 44.5 million metric tons as of 2019. Alongside China, countries such as the USA, Poland, and Turkey are prominent contributors to global apple production(Statista, 2024).In India, although the apple cultivation area stands at a significant 0.305 million hectares, the country ranks fifth in terms of apple production, yielding approximately 2.3 million tons. The commercial cultivation of apple fruit in India is confined to North Himalayan hill region comprising the states of Jammu & Kashmir, Himachal Pradesh and

Uttaranchal and to a limited extent to the states of Arunachal Pradesh, Sikkim, Nagaland, Meghalaya and Manipur covering a total area of 3.08 lakh ha with production of 23.16 lakh tons, productivity of 7.52 tons per hectare and which collectively contribute to 99 percent of the country's total production (Sharma, 2021). In Jammu & Kashmir, the area under apple is 1.65 lakh ha and 18.82 lakh tons and productivity is around 11.40 tons per hectare, followed by Himachal Pradesh with 11.3 metric tonnes per hectare and Uttarakhand with 5.03 metric tonnes per hectare, showcasing the diverse regional contributions to India's apple industry (Bhat *et al.*, 2021).

A number of diseases like scab, Alternaria leaf blotch, Marsonena, Sooty blotch, Fly-speck and a number of post-harvest diseases have been reported to cause losses in apple. Among the foliar diseases, Alternaria leaf blotch caused by *Alternariamali* is one of the most serious disease causing premature leaf fall in apple. The occurrence of Alternaria leaf blotch in J&K was reported by Shahzad *et al.* (2002) and the disease is prevalent in almost all the apple growing districts of Kashmir valley. Alternaria leaf blotch was considered a disease of minor importance in comparison to apple scab. However, the disease resulted in epidemic during summer and about 40-60 percent yield loss was reported (Sofi *et al.*, 2013). Alternarialeaf blotch (*Alternaria mali*Roberts) of apple is one of the major fungaldiseases in all the apple growing regions of the world. Although the disease was previously of minor economic importance in Kashmir valley, it has now attained the status of one of the major diseases of apple (Anonymous, 2000). The frequent epidemics of Alternaria leaf blotch have been witnessed in Kashmir, inflicting heavy losses.

2.MATERIAL AND METHODS

2.1Survey for the incidence andintensity of the disease

A brief survey of important apple growing belts of various districts of Kashmir valley viz., Srinagar ,Pulwama, kulgam and Shopian was conducted during 2021 -2022 to assess the disease incidence and intensity of Alternaria leaf blotch of apple. Twenty villages were selected randomly from these districts and from each village three orchards were selected randomly. A random sample of five apple trees was drawn to represent each orchard. Four branches from the four directions of the tree were randomly selected and tagged. The number of leaves bearing Alternaria leaf blotch symptoms on apple were picked up, one hundred leaves were examined

randomly from each tree for recording the incidence and intensity of Alternaria leaf blotch.

$$\text{Per cent Disease Incidence (PDI)} = \frac{\text{Number of leaves infected}}{\text{Total number of leaves bserved}} \times 100$$

The Alternaria leaf blotch intensity was recorded as per the slightly modified 0-5 scale adopted by Filajdic and Sutton (1991)

Table 1. Checklist for six different categories based on the intensity of the disease

Category	Numerical Value	Criteria
I	0	Disease free
II	1	>0- ≤ 3 % leaf area covered with disease lesions
III	2	>3-≤6% leaf area covered with disease lesions
IV	3	>6-≤12% leaf area covered with disease lesions
V	4	>12-≤25% leaf area covered with disease lesions
VI	5	>25% leaf area covered with disease lesions or chlorotic leaf with petiole infection

The per cent Alternaria leaf blotch intensity was calculated as per the following formula:

$$\text{Percent Disease Intensity} = \sum \frac{n \times v}{\text{N. G}} \times 100$$

Where,

∑ = Summation

N = no of diseased units

V = numerical value of each category

N = total no of units examined

G = highest category value

3.1Experimental Findings

3.1 Status of the disease

The disease survey was conducted in seven districts of Kashmir valley namely, Pulwama, Shopian ,Kulgam and Srinagar during late August in 2007 and 2008 and disease incidence and intensity was recorded.

3.1.1 Disease incidence

The overall mean disease incidence recorded in 2021 was 41.83% as compared to 36.81 % in 2022 (Table 2). Alternaria leaf blotch disease was prevalent in all the four districts surveyed with highest disease incidence of 79.22 percent in district kulgam village khee followed by 70.44 % in district pulwama village kachipora . In Srinagar disease incidence was recorded 60.22% The lowest disease incidence of 41.83 %, irrespectively years was recorded in district Shopian. During 2021, the disease incidence varied from 41.83 % in district Shopian to 71.80 % kulgam and during 2022 it varied from 36 .81 % in Shopian to 61.61 % in kulgam.

The site-wise polled data revealed the highest disease incidence of 79.22 % in Khee village of district Kulgam (Table 2). This was followed by 76.22 % in Chowlgam of district kulgam , 70.44 % in kachipora of district Pulwama and 59.89 % in Drubgam of district Pulwama. The least disease incidence of 32.11 % was recorded in Kachdoora(Distt. Shopian) followed by 34.11 % in Trenz (Shopian) The data in table 2 indicates that Alternaria leaf blotch was present in all the four districts of the Apple growing areas of Kashmir valley The maximum average disease incidence of 71.80% was recorded in district kulgam (2021)Moreover maximum pooled disease incidence of 68.11% was recorded in kulgam district .least pooled disease incidence of 39.32% was recorded in shopiandistrict.During both the years lowest disease incidence was recorded in Kachdoora (Shopian) and highest disease incidence in Khee (kulgam). In district Pulwama ,kachipora recorded the highest disease incidence of 70.44.63 % while Drubgam recorded the lowest of 64.78 %. In district Srinagar highest disease incidence of 60.22 % was recorded in Shalimar and lowest of 43.00 % in Baspora . In district Kulgam ,khee recorded the

highest disease incidence of 79.22 % while Ashmungi recorded the lowest disease incidence of 58.67 %.

3.1.2 Disease Intensity

The data presented in Table 3 revealed that overall disease intensity of 44.14 % recorded in 2021 was higher than 40.17 % recorded in 2022.The pooled data showed that highest disease intensity of 42.15 % was recorded in kulgam followed by 36..78 % in Pulwama . The lowest disease intensity of 22.21 % was recorded in district Shopian.

Disease intensity in different sites varied from 20.55 to 50.78 % in 2021 and 18.91 to 46.21 % in 2008 (Table3). The pooleddata revealed that the disease intensity varied from 22.21 to 36.78 % the highest disease incidence in (Kulgam) followed by 45.78 % in Kachipora (Pulwama) and 38.63 % Murran(Pulwama). The lowest disease intensity of 20.55 % was recorded in Kachdoora (Shopian) while as it was 21.82 % in lehend (Shopian) and 23.67 % in Pahnoo Shopian. In Pulwama highest disease intensity of of 45.78% was recorded in Kachipora followed by 43.23 % in Rajpora and 38.63 % in Murran . In srinagar ,shalimar recorded the disease intensity of 34.89 % followed by 32.65 % and Mulfaq 27.89% . Out of the five sites surveyed in shopian , trenz recorded the highest disease intensity of 26.52 % , while as pinjoora and kachdoora recorded 25.66 % and 20.55 %, respectively. In Kulgam highest disease intensity of 50.78 % was recorded in Khee and the lowest of 38.66 .98 % in Ashmunji.

DISCUSSION

Apple (*Malus domestica*Borkh) is predominant fruit crop of jammu and Kashmir which has attatined the status of an industry in the state .like other horticultural crops, apple is attacked by several pathogens of fungal ,bacterial and viral etiology which impair the quality and quanty of the fruit .However ,huge crop losses are incurred mostly by fungal diseases .Among these Alternaria leaf blotch has assumed an alamaring threat because of the prevalence of disease in all the major apple growing areas of Kashmir valley, Shahzad(2003) recorded Alternaria leaf blotch with varied magnitude of disease incidence and intensity in four districts of kashmir viz, Anantang, Pulwama, shopian and Baramulla. Surveyconducted during the year 2021 and 2022

in four districts of Kashmir valley confirms the prevalence of disease in all the apple growing areas of the valley with an overall mean disease incidence and intensity 55.59and 33.16 percent, respectively. The disease was severe during 2021 with overall mean disease incidence and intensity 58.64 and 34.75 percent in comparsion to 52.54 and 31.58 percent , respectively, in 2022. This higher disease severity could be attributed to higher inoculum build up because of more favourable climatic conditions in 2021 (RH78.23%,RF,81.5mm) than in 2022 (RH71.1%,RF,68.3mm) ,especially during june to August the period conducive for the disease development such conducive environment favoring the disease development has been reported by many researchers (Yoon et al., 1989; Shahzad ,2003).The disease incidence and intensity in surveyed areas varied from 34.28 to 75.28 and 19.73 to 48.49, respectively with highest disease incidence and intensity was recorded in kulgam and lowest in Shopian . The site selection varied from site selction earlier by Shahzad in 2003 .in addition three more districts were covered under survey programme.Shahzad (2003) reported that the Alternaria leaf blotch incidence and intensity among the four districts of the valley varied from 31.37 to 43.50 and 12.34 to 22.57 , respectively , with lowest in Budgam and highest in Anantang district. Of the sites surveyed , the highest disease incidence of 75.28 percent was recorded in Khee (Kulgam)followed by kachipora (Pulwama), Mulfaq (Srinagar) and kachdoora (shopian), with disease incidence of 67.22 ,53.89 and 36.44 percent , respectively .The highest disease intensity of 48.49 percent was also recorded in khee (Kulgam) followed by 43.49 in kachipora (Pulwama),33.32 in Shalimar (Srinagar) and 34.28 in kachdoora (Shopian). Higher disease incidence and severity in various districts and sites surveyed could be attributed to higher plant density ,besides non –disposal of the fallen diseased leaves and heavy infestation of European red mite (*Panchusulmi*) which facilitates the penetration of *A. mali* .Filajdic*et al* (1995) observed more disease severity with increased Mite population .Occasionalor neglected spray programme followed in these areas seem to have contributed in building mite population density threshold .The least disease incidence (34.28%) and intensity (19.73%) was recorded in the Kachdoora of district shopian .The less disease incidence and intensity could be attributed to lesser plant density and better orchard management .Overall, variation in disease severity may be because the variation in various factors like,altitude , climate,plant age and management practices .

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Table 2: Incidence of Alternaria leaf blotch of apple at different districts of Kashmir valley during 2021 &2022

District	Sites	Per cent Disease Incidence 2021	Per cent Disease Incidence 2022	Pooled Per cent Disease Incidence

Pulwama	Pulwama L-1	69.44	63.22	66.33
	Pulwama L-2	70.44	64.00	67.22
	Pulwama L-3	63.78	58.00	60.89
	Pulwama L-4	59.89	54.56	57.22
	Pulwama L-5	64.78	58.89	61.83
Overall mean ± SE.(m)		**64.69±2.17**	**58.87±1.97**	**61.77±2.07**
C.I 95% Limits		**57.80-71.58**	**52.59-65.14**	**55.20-68.36**
Srinagar	Srinagar L-1	56.89	50.89	53.89
	Srinagar L-2	55.89	49.11	52.50
	Srinagar L-3	48.89	43.00	45.94
	Srinagar L-4	52.78	46.44	49.61
	Srinagar L-5	60.22	53.67	56.94
Overall mean± SE.(m)		**54.42±2.39**	**48.04± 2.23**	**51.23±2.31**
C.I 95% Limits		**48.81-62.04**	**40.95-55.14**	**43.88-58.51**
Kulgam	Kulgam L-1	79.22	71.33	75.28
	Kulgam L-2	70.44	63.33	66.89
	Kulgam L-3	65.11	58.67	61.89
	Kulgam L-4	76.22	68.56	72.39
	Kulgam L-5	68.00	60.22	64.11
Overall mean± SE.(m)		**71.80±2.55**	**64.61± 2.35**	**68.11±2.44**
C.I 95% Limits		**64.50-79.04**	**58.10-71.12**	**61.23-74.99**
Shopian	Shopian L-1	44.78	39.44	42.11
	Shopian L-2	42.89	37.78	40.33
	Shopian L-3	49.33	43.44	46.39
	Shopian L-4	38.67	34.11	36.39
	Shopian L-5	36.44	32.11	34.28
Overall mean± SE.(m)		**41.83±2.83**	**36.81±2.49**	**39.32±2.66**
C.I 95% Limits		**32.80-50.86**	**28.86-44.76**	**30.83-47.81**
Total Disease Incidence± SE.(m)		**58.64±2.76**	**52.54±2.56**	**55.59±2.66**
C.I 95% Limits		**52.88-64.42**	**47.15-57.92**	**50.02-61.17**

*Average of three sites from each location in a District

** From each site 300 leaf samples were examined for the disease

***C. I=Confidence interval

Table 3: intensity of Alternaria leaf blotch of apple at different districts of Kashmir valley during 2021 & 2022

District	Sites	Per cent Disease Intensity 2021	Per cent Disease Intensity 2022	Pooled Per cent Disease Incidence
Pulwama	Pulwama L-1	43.23	38.91	41.07
	Pulwama L-2	45.78	41.20	43.49
	Pulwama L-3	36.90	33.21	35.06
	Pulwama L-4	33.54	30.19	31.86

	Pulwama L-5	38.63	34.77	36.70
Overall mean ± SE.(m)		**38.71±2.58**	**34.84±2.32**	**36.78±2.45**
C.I 95% Limits		**30.50-46.93**	**27.45-42.24**	**28.97-44.58**
Srinagar	Srinagar L-1	32.65	29.71	31.18
	Srinagar L-2	32.45	29.53	30.99
	Srinagar L-3	27.89	25.38	26.63
	Srinagar L-4	30.11	27.40	28.76
	Srinagar L-5	34.89	31.75	33.32
Overall mean± SE.(m)		**31.34± 1.51**	**28.52± 1.37**	**29.92± 1.44**
C.I 95% Limits		**26.54-36.13**	**24.15-32.88**	**25.35-34.50**
Kulgam	Kulgam L-1	50.78	46.21	48.49
	Kulgam L-2	43.78	39.84	41.81
	Kulgam L-3	38.66	35.18	36.92
	Kulgam L-4	46.25	42.09	44.17
	Kulgam L-5	41.23	37.52	39.37
Overall mean± SE.(m)		**44.14± 2.09**	**40.17± 1.89**	**42.15± 1.99**
C.I 95% Limits		**38.34-49.94**	**34.89-45.44**	**36.62-47.69**
Shopian	Shopian L-1	25.66	23.61	24.63
	Shopian L-2	23.67	21.78	22.72
	Shopian L-3	26.52	24.40	25.46
	Shopian L-4	21.82	20.07	20.95
	Shopian L-5	20.55	18.91	19.73
Overall mean± SE.(m)		**23.14±1.29**	**21.28±1.19**	**22.21±1.24**
C.I 95% Limits		**19.02-27.26**	**17.49-25.08**	**18.25-26.17**
Total Disease Incidence± SE.(m)		**34.75±1.96**	**31.58±1.75**	**33.16±1.86**
C.I 95% Limits		**30.64-38.86**	**27.91-35.25**	**29.28-37.06**

*Average of three sites from each location in a District

** From each site 300 leaf samples were examined for the disease

***C. I=Confidence interval