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Field Status of Purple Blotch of Onion Caused by *Alternaria porri*

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A B S T R A C T

Investigation was carried out on roving survey for recording the severity of purple blotch disease of onion during *Rabi* 2015-16 and 2016-17 in nine districts of Rajasthan *viz*., Bikaner, Alwar, Jaipur, Jhunjhunu, Jodhpur, Sikar, Chittorgarh, Sriganganagar and Baran, and two district of Haryana *viz*., Hisar and Bhiwani and one district of Punjab *viz*., Abohar. The intensity of disease was noted by counting at least 100 plants in each field. Observation on purple blotch intensity was recorded; the symptoms expressed as initial small, water-soaked lesions later turned to light yellow to brown coloured. The per cent disease severity was calculated by using 0-5 point disease rating scale. On the basis of survey and surveillance of purple blotch of onion incited by *Alternaria porri* and found that Alwar district has maximum disease severity 11.21 and 11.99% in *Rabi* 2015-16 and 2016-17, respectively and minimum disease severity was observed in Chittorgarh 8.04 and 9.11% in *Rabi* 2015-16 and 2016-17, respectively. The observation of this survey is very useful to identify the hot spot of this disease.

Introduction

Allium, a large genus containing five hundred or more species, belongs to the family *Alliaceae*. There are five important species of the genus *Allium* of which the onion is the most important crop (Messiaen, 1994). Onion is ranked as one of the five most important fresh market vegetable crops world-wide (Cramer, 2000). Onion are used both as food and also for seasoning, the immature and mature bulbs are eaten raw or they may be cooked and eaten as a vegetable (Messiaen, 1994). Among vegetables, onion (*Allium cepa* L.) often called as "Queen of Kitchen" is one of the oldest known and an important vegetable crop grown in India. Onion contains the lachrymatory agent, a strong antibiotic, with fungicidal, bacterial and nematocidal properties (Purseglove, 1972). Onion a bulbous, biennial herb is one of the most important vegetable crops grown throughout world and in India. As a vegetable and spice, it is used both as tender and mature bulb. In bulb group of vegetables, onion is the most important crop. The bulb is composed of

concentric, fleshy, enlarged leaf bases or scales. It is consumed throughout the year by almost all classes of people on account of its medicinal and dietary value. Due to use of onion blood pressure, diabetes and blood fat are controlled. The young green onions are used as salad, while the mature bulbs are used as food for cooking vegetables (Smith, 2003). In onion there is report of high levels of photochemical especially flavonols, which provide colour, texture and taste in onions.

India stand second in area and third in production with a 23 million tonnes (mt) production in 12 lakh hectare area with productivity of 18.10 t/ha (Anonymous, 2018). Indian onions are marketed in Bangladesh, Malaysia, Sri Lanka, U.A.E, Pakistan and Nepal. In Rajasthan, it is cultivated in 0.10 lakh hectares with productivity of 15.40 mt/ha a total production of 6.47 lakh tons (Anonymous, 2018). Onion is cultivated in all season throughout the country. The major onion producing states are Maharashtra, Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan and Haryana (Anonymous, 2018).

Onion is highly susceptible to many foliar, bulb and root pathogens, which reduce yield and quality (Cramer, 2000). Among the diseases, purple leaf blotch (PLB) and Stemphylium leaf blight (SLB) are the major diseases of onion worldwide (Awad *et al.*, 1978, Everts and Lacy 1990 (a, b), Brar *et al.*, 1990, Aveling *et al.*, 1993, 1994, Chaput 1995, Cramer, 2000). The PLB and SLB have been reported on many species of *Allium* family including onion (*A. cepa*), Egyptian onion (*A. proliferum*), Welsh onion (*A. fistulosum*) and leek (*A. ampeloprasum*var. *porrum*) world-wide (Sherf and Mcnab 1986). Among the various foliar diseases of onion, purple blotch caused by *Alternaria porri* is one of the most destructive diseases, due to this disease yield loss ranging from 2.5 to 87.8 per cent during *Kharif* season (Shrivastava *et al*., 1994). Considering the above, the present study was undertaken to survey and surveillance of *Alternaria porri* causing purple blotch of onion to standardize innovative onion purple blotch complex management approaches.

Materials and Methods

Four villages, from each selected district were surveyed for the purpose were examined randomly and scored for disease severity by following 0-5 scale.

PDI was calculated by using the following formula (Pathak *et al*., 1986);

$$PDI = \frac{\text{Sum of all individual disease rating}}{\text{Total number of plants assessed} \times \text{Maximum rating}} \times 100$$

Collection of diseased plant material

Naturally infected onion leaves showing typical well developed purple blotch symptoms were collected from Agricultural Research Station, Bikaner and brought to laboratory. The infected leaves were thoroughly washed with running tap water and then immediately examined under a compound microscope for preliminary identification of the pathogen. Later on, the fungus was brought into pure culture on potato dextrose agar medium using following method:

Sterilization all the glassware were cleaned with potassium dichromate or sulphuric acid solution and washed with sterilized water and sterilized in hot air oven at 160˚C for 2 hours. Culture medium (Potato Dextrose Agar) was sterilized by autoclaving at 1.045 kg / cm^2 pressure for 20 minutes. Soil used in the present study was sterilized at 1.045kg /cm^2 pressure for one and half hour on two

consecutive days. The earthen pots were sterilized by dipping then in 10 per cent formaldehyde solution for 5 minutes.

Purification and maintenance of *Alternaria porri* isolation of the fungus was made by tissue isolation technique. Typical diseased spots on leaves were selected and cut into small bits with the help of a sterilized blade. These bits of diseased tissues were washed with sterilized distilled water and disinfected with 0.1 per cent mercuric chloride ($HgCl_2$) solution for 30 to 60 seconds. These disinfected bits were immediately washed thrice with sterilized distilled water to remove excess mercuric chloride. These bits were placed on the surface of Petri plates containing potato dextrose agar (PDA) and incubated at 27±1℃ for 10 days. The resulting fungus culture was purified by hyphal tip technique in PDA slant. The pure culture was maintained on PDA by storing it under refrigeration at 5^0C and making periodical transfers at every fortnight.

Single spore isolation ten ml of clear, sterilized water agar of 2 per cent strength was poured into Petri plates and was allowed to solidify. Dilute spore suspension was prepared using sterilized distilled water from 12 days old culture. One ml of such suspension was spread uniformly on 2 per cent water agar plates. The plates were incubated at 27±1°C for 8 hours. Then, such plates were examined under microscope to locate germinated conidia. Single isolated and germinated conidia were then marked under the microscopic field on the surface of the plate. These marked agar areas were cut and transferred to PDA slants with the help of cork borer under aseptic conditions and incubated at a temperature of 27±1°C. The growth of fungus in slants was used to study the morphological characters. As single spore isolates were identical and multiplied further. Pure culture derived from such slants was used for further studies.

Maintenance of the culture

The pathogen was sub cultured on PDA slants and allowed to grow at 27±1°C for ten days and such slants were preserved in a refrigerator at 5°C and renewed once in 30 days.

Proving the pathogenicity

Onion seedlings (cv. N-53) were raised in earthen pots, size 6" X 5", filled with sterilized soil. Plants were thoroughly cleaned with sterilized distilled water using moist cotton. Later, the plants were sprayed with distilled water. They were covered with polythene bags for 24 hrs. Onion seedlings (injured with brush) were inoculated with mycelial suspension prepared from 10 days old culture, suitable controls were maintained. Plants were injured with brush in control and maintained by spraying water only instead of mycelial suspension of the causal fungus. The seedlings were covered with polyethylene bags and were incubated for 120 hrs to ensure successful penetration of the pathogen into the host tissue. The polythene bags removed after five days and seedlings were kept under greenhouse conditions. Observations were made regularly for the appearance and development of symptoms. After appearance of disease symptoms, reisolation was made from the diseased tissues of artificially infected plants. The isolate obtained was compared with the original culture for confirmation of fungus under study.

Results and Discussion

A roving survey was carried out for recording the severity of purple blotch disease of onion during *Rabi* 2015-16 and 2016-17 in nine districts of Rajasthan *viz*., Bikaner, Alwar, Jaipur, Jhunjhunu, Jodhpur, Sikar, Chittorgarh, Sriganganager and Baran, and two district of Haryana *viz*., Hisar and

Bhiwani and in one district of Punjab *viz*., Abohar. The intensity of disease was noted by counting at least 100 plants in each field. Observation on purple blotch intensity was recorded; the symptoms expressed as initial small, water soaked lesions later turned to light yellow to brown coloured. The per cent disease severity was calculated by using 0-5 point disease rating scale. The survey was conducted when the onion crop stage between 90-105 days after transplanting in different districts of Rajasthan and nearby states during Rabi 2015-16 and 2016-17. The survey for symptomatology, severity, distribution and spread was carried out at physiological maturity and the data pertaining to survey work is presented in Table 1.

The district wise observations were given in Table 2. The data indicated that the disease appeared in severe form during both the crop seasons (*Rabi* 2015-16 and 2016-17). But, the disease severity during was more *Rabi* 2016-17 than *rabi* 2015-16.

During *Rabi* 2015-16, among the different districts, Bahrampur in Alwar district recorded maximum disease severity (14.81%) and next highest disease severity was recorded at Jaakhak village in Jhunjhunu (12.20%). Magupura village in Chittorgarh district recorded least disease severity (6.65%) of purple blotch caused by *A. porri*. Highest average mean disease severity 11.21% was recorded at Alwar district followed by Sikar with 10.66%.

During *Rabi* 2016-17, the disease severity of purple blotch was observed higher compared to *Rabi* 2015-16 in all the locations. Highest average mean disease severity of purple blotch of onion during 2016-17 was observed in Alwar district (11.99%) followed by Abohar (10.78%) and Sikar (10.69%) districts. In Alwar district, Kalwari village recorded highest disease severity (14.12%) followed by Kular (11.97%) and Palsana (11.80%) in Abohar and Sikar district, respectively. Jasrasar of Bikaner district recorded least (8.00%) disease severity in *Rabi* 2016-17.

The survey and surveillance work were under taken to know the severity and distribution of purple blotch of onion in Rajasthan and nearby districts of Punjab and Haryana states during *Rabi* 2015-16 and 2016-17. A detailed roving survey was undertaken during *Rabi* 2015-16 and 2016-17 in districts and adjoins area of Rajasthan to gather information on the symptomatology, severity, distribution and spread of purple blotch of onion, This information is highly useful to indentify the hot spots of this disease in Bikaner, Alwar, Jaipur, Jhunjhunu, Jodhapur, Sikar, Chittorgarh, Srigangangar, Baran, Hissar, Bhiwani and Abohar districts where onion is extensively grown as commercial crop.

Table.1 Per cent disease intensity (PDI) range

Disease rating	Per cent disease intensity (PDI) Range	Reaction
0.	0 to 5%	Immune
1.	5to 10%	Resistant
2.	11 to 20%	Moderately Resistant
3.	21 to 40%	Moderately Susceptible
4.	41 to 60%	Susceptible
5.	More than 61%	Highly Susceptible

Table.2 Per cent disease severity of purple blotch of onion caused by *A. porri* in onion growing area

Sr. No.	District/Village	Stage of the crop days after transplanting (in days)	Type of soil	Variety	Irrigation method	Cropping pattern	Disease intensity (%)		Mean (%)
							2015-16	2016-17	
1.	**Bikaner**								
	Jasrasar	90-95	Loamy sand	N-53	Sprinkler	GN:CB	8.00	8.00	8.00
	Raisar	90-95	Sandy loam	N-53	Sprinkler	GN:CB	12.07	10.92	11.49
	Khara	90-95	Loamy sand	N-53	Sprinkler	CB:GN	11.18	10.59	10.88
	Akkasar	92-95	Sandy loam	N-53	Sprinkler	CB:GN	9.72	11.11	10.42
	Nokha	90-95	Loamy sand	N-53	Sprinkler	CB:MO	10.20	11.56	10.88
	Average						**10.23**	**10.44**	10.34
2.	**Alwar**								
	Adoli	95-100	Sandy loam	N-53	Sprinkler	PM:CB	9.09	9.38	9.23
	Bahrampur	95-100	Sandy clay loam	RO-1	Sprinkler	PM:CB	14.81	12.50	13.66
	Nerka	96-100	Sandy loam	RO-1	Sprinkler	PM:CB	10.33	11.96	11.14
	Kalwari	95-100	clay loam	N-53	Sprinkler	PM:CB	10.59	14.12	12.35
	Average						**11.21**	**11.99**	11.60
3.	**Jaipur**								
	Bassi	92-96	Loamy sand	N-53	Sprinkler	PM:CB	9.41	9.41	9.41
	Chomu	95-100	Loamy sand	N-53	Sprinkler	PM:CB	11.11	14.81	12.96
	Durgapura (RARI)	90-95	Loamy sand	RO-1	Sprinkler	PM:CB	9.11	7.29	8.20
	Average						**9.88**	**10.51**	10.19
4.	**Jhunjhunu**								
	Bisau	88-92	Sandy loam	N-53	Sprinkler	CO:PM	9.52	9.52	9.52
	Chidawa	90-95	Sandy loam	N-53	Sprinkler	CO:PM	9.59	9.59	9.59
	Jaakhal	95-100	Sandy loam	N-53	Sprinkler	PM:CO	12.20	10.00	11.10
	Udaipur wati	92-95	Sandy loam	N-53	Sprinkler	PM:CO	9.50	11.88	10.69
	Average						**10.20**	**10.25**	10.23

5.	**Jodhpur**								
	Indroga	90-95	Sandy loam	RO-1	Sprinkler	PM:MU	9.56	11.94	10.75
	Mathaniya	92-96	Sandy loam	RO-1	Sprinkler	PM:MU	11.36	9.55	10.45
	Baleshwar	90-95	Loamy sand	N-53	Sprinkler	PM:MU	10.96	10.96	10.96
	Balarwa	86-90	Sandy loam	RO-1	Sprinkler	PM:MU	8.42	8.42	8.42
	Average						**10.07**	**10.22**	10.15
6.	**Sikar**								
	Data Ramgarh	98-102	Loamy sand	N-53	Sprinkler	GN:CO:PM	11.18	11.76	11.47
	Palsana	95-100	Loamy sand	N-53	Sprinkler	GN:CO:PM	8.99	11.80	10.39
	Khachariyavas	95-100	Sandy loam	N-53	Sprinkler	GN:CO:PM	10.79	8.63	9.71
	Kanwarpura	98-102	Loamy sand	N-53	Sprinkler	GN:CO:PM	11.67	10.56	11.11
	Average						**10.66**	**10.69**	10.67
7.	**Chittorgarh**								
	Pilada	90-95	Loamy sand	N-53	Sprinkler	SB :GN	7.69	10.00	8.85
	Magpura	88-92	Loamy sand	N-53	Sprinkler	SB:GN	6.65	10.87	8.76
	Dorai	88-92	Loamy sand	N-53	Sprinkler	SB:GN	8.82	8.82	8.82
	Jaisinghpura	85-90	Loamy sand	N-53	Sprinkler	SB:GN	8.99	6.74	7.87
	Average						**8.04**	**9.11**	8.57
8.	**Sri Ganganagar**								
	Ganeshgarh	92-96	Clay loam	Red shine	Flood	CT:CB	9.33	11.67	10.50
	Bhompura	94-98	Clay loam	Red shine	Flood	CT:CB	9.41	11.76	10.59
	Dabla	92-96	Sandy loam	Red shine	Flood	CT:CB	10.33	10.33	10.33
	Nirwana	92-96	Sandy loam	Red shine	Flood	CT:CB	9.09	11.36	10.23
	Ridmalsar	90-95	Sandy loam	Red shine	Flood	CT:CB	7.50	6.00	6.75
	RampuraNayola	85-90	Sandy loam	Red shine	Flood	CT:CB	7.39	7.39	7.39
	Average						**8.84**	**9.75**	9.30
9.	**Baran**								
	Hatwari	90-95	Sandy loam	N-53	Flood	SB:PD:BG	8.00	10.00	9.00
	Bhanwargarh	92-95	Sandy loam	N-53	Flood	SB:PD:BG	11.90	11.90	11.90
	Khandela	92-95	Sandy loam	RO-1	Flood	SB:PD:BG	9.13	9.13	9.13
	Anta	90-95	Sandy loam	RO-1	Flood	SB:PD:BG	11.67	11.67	11.67

	Average						**10.18**	**10.68**	10.43
10.	**Hisar**								
	Barwala	88-92	Sandy loam	Balwanpyaj	Flood	PM:MU	7.83	9.78	8.80
	Baichpuri	90-95	Sandy loam	Balwanpyaj	Flood	PM:MU	8.64	8.64	8.64
	Dhand	92-96	Loamy sand	Balwanpyaj	Flood	PM:MU	10.87	10.87	10.87
	Dhanichanran	90-95	Sandy loam	Balwanpyaj	Flood	PM:MU	8.70	10.33	9.51
	Average						**9.01**	**9.90**	9.46
11.	**Bhiwani**								
	Damkora	94-98	Sandy loam	Balwanpyaj	Flood	PM:CB	11.03	11.07	11.05
	Jhanjhara bass	88-92	Sandy loam	Balwanpyaj	Flood	PM:CB	8.72	8.68	8.70
	Pahadi	88-92	Sandy loam	Balwanpyaj	Flood	PM:CB	8.63	8.63	8.63
	Dhanitoda	90-94	Sandy loam	Balwanpyaj	Flood	PM:CB	10.80	11.73	11.27
	Average						**9.80**	**10.03**	9.91
12.	**Abohar**								
	Kular	94-98	Clay loam	Punjab white	Flood	CT:PD	11.95	11.99	11.97
	Bajeetpura	94-98	Clay loam	Punjab white	Flood	CT:PD	11.43	11.39	11.41
	Kilawali	90-95	Sandy loam	Punjab naroy	Flood	CT:PD	8.66	8.74	8.70
	Panjkoshi	92-96	Clay loam	Punjab white	Flood	CT:PD	8.88	11.01	9.95
	Average						**10.23**	**10.78**	10.51
	Mean						**10.15**	**10.36**	10.11

PM = Pearl millet [*Pennisetum Americana* (L.)Moench], MU = Mung [*Vigna radiata* (L.) Wilczek], PD = Rice [(*Oryza sativeum)* (L.)], BG = Black Gram [*Vigna mungo* (L.) Hepper], SM = Sesamum [*Sesamum indicum* (L.)], CO = Cow pea [*Vignaunguiculata* (L.) Walp.], CT = Cotton [*Gossypium hirsutum*], CB = Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.], GN = Groundnut [*Arachishypogaea* (L.)], MO = Mothbean [*Vigna aconitifola* (Jacq.) Marchel]

From the survey it is revealed that the severity of this disease varied from locality to locality and varieties of the crops. The severity of disease was also dependent on inoculum load, environmental conditions prevailing in different localities. Among the districts surveyed, the severity of disease was more in Alwar (11.60%) and less in Chittorgarh (8.57%) indicating that this disease was not consistent in all localities. The leaf blight of onion was severe in Alwar district compared to Bikaner district. This could be because of favorable environmental conditions and initial inoculums prevailed. This might have helped in the rapid development of the disease in *Rabi* when favourable environmental conditions prevailed. Working on survey of *Alternaria* leaf blight disease of onion, Patil and Patil (1991) concluded that it is the most predominant and severe disease in the onion growing centers of Maharashtra.

In conclusion, the per cent disease severity was calculated by using 0-5 point disease rating scale. On the basis of survey and surveillance of purple blotch of onion incited by *Alternaria porri* and found that Alwar district has maximum disease severity and minimum disease severity was observed in Chittorgarh.

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