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RESEARCH PAPER

Survey for severity of purple blotch and screening of onion varieties against purple blotch disease caused by *Alternaria porri* in North Eastern Karnataka

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Abstract: Onion purple blotch caused by the fungus *Alternaria porri* is a major yield limiting factor in Onion growing areas of Karnataka**.** A roving survey was conducted to assess purple blotch disease severity in onion during *kharif* 2016 in North Eastern Karnataka. The disease severity ranged from 9.60 to 86.40 per cent. The highest disease severity was noticed in Garjanal village (86.40%) in Koppal district and the least disease severity was recorded in Dornahalli village (9.60%) in Yadgir taluk. It was concluded that, maximum severity in Koppal district might due to monocropping, prevalence of congenial micro climate, existence of initial inoculum and cultivation of susceptible varieties in larger scale. Out of 15 screened onion varieties mainly two varieties viz., Bheema Shakti and Bheema Super were found to have moderate resistance by recording a disease severity of 18.92 per cent and 19.80 per cent respectively, Where as Bellary red recorded highly susceptible reaction with disease severity of 74.86 per cent and hence it can be considered as fast blight cultivar.

Key words: Disease severity, Inoculum, Onion, Purple blotch

Introduction

Onion is one of the oldest known vegetable crop popularly called as "queen of kitchen". The genus *Allium* is comprising of more than 700 spp and belongs to the family Alliaceae. Vavilov (1951) reported its primary centers of origin as Central Asia and the Near East and Mediterranean are the secondary centers of origin. Onion provides excellent taste to dishes along with a number of theraptic properties such as antibacterial, antifungal, antihelmintic, anti-inflammatory, antiseptic etc (Augusti, 1996). As per the world scenario of onion during 2015-16, China was the major producer of onion with 26.3 per cent followed by India with 22.6 per cent and USA occupied 3rd place with 3.8 per cent of production (Anon., 2015). In India onion occupied an area of about 1.22 m. ha with a production of 20.99 million tonnes and productivity of 21.2 tonnes per ha during the year 2016-17.

Several factors have been identified for the low productivity of onion in India. Among those, the diseases like purple blotch, downy mildew, *Stemphylium* blight, basal rot, *Botryt* is leaf blight, blast and storage rots cause major loss. However, purple blotch is the major disease causing 25 to 50 per cent loss in bulb yield of onion in India (Augusti, 1996) and severe attack on flowering *Alliums* can completely girdle flower stalks with necrotic tissue, causing their collapse and total loss of seed production capacity. The pathogen Alternaria porri destructs the leaf tissue which destroys the stimulus for bulb initiation and delays bulbing and maturation (Pandotra, 1964). In view of this a survey was conducted to know the severity of purple blotch in onion growing areas of North Eastern Karnataka and onion varieties were screened to find out the resistant variety.

Material and methods

The survey for the purple blotch of onion was undertaken to assess the severity of purple blotch in five districts of North Eastern Karnataka during *kharif* 2016 *viz.,* Raichur, Yadgir, Kalaburgi, Koppal and Ballari. Observations were recorded with respect to severity of purple blotch disease, soil type, variety and method of crop establishment and samples were collected for isolation of the pathogen. In the field, onion plants were randomly selected to score disease severity.

Scoring of the disease was done in the field by using 0 to 5 scale given by Mayee and Datar (1986). The per cent disease index (PDI) was calculated by using formula given by Wheeler (1969).

$$PDI = \frac{\text{Sum of all individual disease ratings}}{\text{No. of leaves observed}} \times \frac{100}{\text{Maximum disease grade}}$$

0-5 disease scale

0: No disease symptoms

1: A few spots towards tip covering 10 per cent leaf area

2: Several dark purplish brown patch covering up to 20 per cent leaf area

3: Several patches with pale outer zone covering up to 40 per cent leaf area

4: Leaf streaks covering up to 75 per cent leaf area or breaking of the leaves from centre

5: Complete drying of the leaves or breaking of leaves from centre

Field screening of onion varieties against purple botch of onion

The screening of onion varieties was done during *kharif* 2016 to find out the source of resistance to purple blotch of onion. Total of 14 varieties *viz.,* Arka Lalima, Arka Kirthiman, Arka Bheem, Arka Niketan, Arka Kalyan, Bheema Shubra, Bheema Shakti, Bheema Kiran, Bheema Red, Bheema Swetha, Bheema Super, Bheema Dark Red, Bheema Raj, Arka Pragathi along with susceptible check Bellary red were collected from Indian Institute of Horticultural Research, Bengaluru and Directorate of Onion and Garlic Research, Rajgurunagar Pune. The seeds were sown in plot size of 2.5 x 1.0 m with a spacing of 15x10 cm in randomized block design with three replications. Bellary red was used as local check. The varieties were screened under natural epiphytotic conditions. Later the disease severity was calculated by using 0 to 5 scale given by Mayee and Datar (1986) and per cent disease index was calculated by using the formula given by Wheeler (1969). The varieties were grouped in to different categories of resistance and susceptibility varieties based on disease reaction.

Results and discussion

The detailed survey was undertaken in parts of North Eastern Karnataka to gather information on severity and spread of *Alternaria porri* causing purple blotch of onion in different locations. This information is highly useful to identify the hot spots of this disease in Koppal, Yadgir, Kalaburgi, Raichur and Ballari where onion is extensively grown as a commercial crop. From the survey it was evident that the disease severity varied from one locality to another based on the soil type and cultivar used.

The highest severity of purple blotch disease was noticed in fields of Garjanal village (86.40 %) in Koppal district, followed by Umbli Rampura village (60.80 %) of Kushtagi taluk. In Raichur district, maximum severity of purple blotch was observed in Kadagamdoddi village (50.40%) of Raichur taluk, where as the least severity was noticed in Galaga village (32.80%) of Deodurga taluk. In Yadgir district, maximum disease severity was recorded in Devapura village (20.00%) of Shahapur taluk and the least severity was noticed in Dornahalli village (9.60%) in Yadgir taluk (Table 1).

*I*n Kalaburgi district, maximum severity was observed in Basavanthavadi village (28.80%) of Aland taluk and the least severity was recorded in Aaluru village (15.20%) of Aland taluk. In Koppal district, maximum disease severity was recorded in Garjanal (86.40%) village of Kushtagi and the least severity was noticed in Asagal village (34.00%) of Koppal taluk. In Ballari district, maximum purple blotch severity was recorded in Dibbadahalli village (58.00%) and the least severity was noticed in Koluru and Sandooru villages (19.20%) in Ballari taluk.

The least disease severity was recorded in Doranhalli village (9.60 %) of Yadgir district. Maximum average disease severity of 54.40 per cent was recorded in Koppal district, where local varieties occupied larger area and this was followed by Raichur (39.60%) and Ballari district (26.60%). The lowest disease severity of 15.60 per cent was recorded in Yadgir district, where onion was grown in black soils (Table 2).

Maximum severity of purple blotch might be due to cultivation of same crop year after year *i.e.,* monocropping, frequent irrigation in red soils created high relative humidity at micro climate level, existence of initial inoculum in that particular location and cultivation of same varieties in larger scale which helped in development of disease and perpetuation of pathogen. Similar results are also observed by Srivastava et al., (1994) in their research on status of field diseases and insect pest of onion in India indicated that purple blotch incidence was high in both rainy and post-rainy seasons when high humidity prevailed. Patil (1999) reported, maximum incidence of disease in Dharwad and Gokak taluks during *kharif* 1998 and *rabi* 1998-99 while surveying purple blotch incidence on garlic. The results are also in conformity with Chethana (2000), who noticed the highest per cent disease incidence in Ronihal village (Basavanabagewadi taluk) of Bijapur district and lowest in Wadullur village of Raichur taluk. Similar findings were also reported by Shrikanth (2000) carried out survey to study the leaf blight of garlic during *kharif* and *rabi* 1998-99 in parts of Karnataka and notice highest disease severity (83.27%) in Dharwad taluk during *kharif* and Gokak taluk (77.15%) during *rabi* and Prakash (2007) reported highest disease severity in horticulture garden, Raichur (49.63%) and least was recorded in Neermanvi (10.00%). Similar findings were observed with Pramodkumar (2007) reported highest disease severity of purple blotch disease in districts of Northern Karnataka *viz.,* Dharwad, Bagalkot, Bijapur, Belgaum, Gadag and Haveri and Priya (2013) reported highest per cent disease index of purple blotch was noticed in Ilkal village of Bagalkot and least was noticed in Kerur village of Bhagalkot district and Pradnyarani *et al.* (2014) noticed the highest per cent disease index of purple blotch was in fields of Sangreshkoppa (46.00) village in Belgaum district, whereas, the least per cent disease index was recorded at Hulkund (3.00) village in Belgaum district.

Field screening of onion varieties against purple botch of onion

The field screening experiment was conducted at MARS, Raichur, University of Agricultural Sciences, Raichur during *kharif* 2016 to find out the source of resistance to purple blotch of onion revealed that, out of 14 varieties screened, along with susceptible check, under natural epiphytotic conditions., none of them were found to be immune. However, two varieties *viz.,* Bheema Shakti and Bheema Super registered moderate resistance by recording a disease severity of 18.92 per cent and 19.80 per cent respectively and thus were grouped in moderately resistant category. Twelve varieties viz., Arka Lalima, Arka Kirthiman, Arka Bheem, Arka Niketan, Arka Kalyan, Bheema Shubra, Bheema Kiran, Bheema Red, Bheema Swetha, Bheema Dark Red, Bheema Raj and Arka Pragathi were found in moderately susceptible category. One variety i.e., Bellary red showed highly susceptible reaction with per cent disease index of 74.86 and was grouped as highly susceptible to the onion purple blotch disease (Table 3).

Table 1. Survey for severity of purple blotch disease in onion growing areas of North Eastern Karnataka during *kharif* 2016

Sl. No.	District	Taluk	Village	Soil type	Variety	Scale		PDI (%)
1	Raichur	Raichur	Chandrabanda	Red	Local	4		48.00
			Nagamdoddi	Red	Local	3		33.60
			Kadagamdoddi	Red	Local	4		50.40
							Mean	44.00
		Deodurga	Dodambli	Red	Local	3		37.60
			Galaga	Red	Local	3		32.80
			Hirebudur	Red	Local	3		35.20
							Mean	35.20
							District mean	39.60
2	Yadgir	Yadgir	Chatnalli	Black	Nasik red	2		14.40
			Doranhalli	Black	Local	1		9.60
			Gonal	Black	Local	2		16.00
							Mean	13.33
		Shahapur	Devapura	Black	Panchaganga	2		20.00
			Devatkal	Black	Nasik red	2		17.60
			Devikera	Black	Nasik red	2		16.00
							Mean	17.86
							District mean	15.60
3	Kalaburgi	Kalaburgi	Pattana	Black	Panchaganga	3		21.60
			Savalagi	Black	Nasik red	3		24.40
			Bhimalli	Black	Local	3		24.40
							Mean	23.46
		Aland	Aaluru	Black	Local	2		15.20
			Dharmavadi	Black	Panchaganga	3		24.00
			Basavanthavadi	Black	Local	3		28.80
							Mean	22.66
							District mean	23.06
4	Koppal	Koppal	Hirebommanala	Red	Local	4		43.20
			Asagal	Red	Local	3		34.00
			Methagal	Red	Local	4		51.60
							Mean	42.93
		Kustagi	Garjanal	Red	Local	5		86.40
			Joolakunti	Red	Local	4		50.40
			Umbli Ramapura	Red	Local	5		60.80
							Mean	65.86
							District mean	54.40
5	Ballari	Ballari	Koluru	Red	Ballari red	2		19.20
			Sondooru	Red	Ballari red	2		19.20
			Karekal	Red	Ballari red	2		20.00
							Mean	19.46
		Hagari bommanahalli	Ambali	Red	Ballari red	3		22.40
			Dibbadhalli	Red	Ballari red	4		58.00
			Bannikallu	Red	Ballari red	2		20.80
							Mean	33.73
							District mean	26.60

Method of crop establishment by transplanting

The management of disease through host plant resistance has been the best choice in all the crops. Utilization of resistant cultivars in farming system is the most simple, effective and economical method in the management of diseases. Besides this, these resistant cultivars conserve natural resources and reduce the cost, time and energy compared to the other methods of disease management. Chethana *et al.* (2011) screened onion varieties against purple blotch under field conditions and found Rampur Rose, Agrifound Rose, Arka Pragati, Arka Niketan, Arka Pitamber and Arka Bindu were moderately susceptible to purple blotch of onion. In the present study Arka Pragathi and Arka Niketan showed moderately susceptible reaction. Similarly, Tripathy *et al.* (2013) evaluated 21 varieties and advanced varieties along with five national checks against purple blotch disease and found NRCRO-3, NRCWO-3, NRCWO-4, VG-19 and Bhima Super showed moderately resistance reaction to purple blotch disease.

The present findings are also in line with the report of Kamlesh and Sharm (2004), Kamlesh *et al.* (2006) and Shashikanth *et al.* (2007) and Kale and Ajjappalavara (2014)

Table 2. Severity of purple blotch of onion in different districts of North Eastern Karnataka during *kharif* 2016

Sl. No.	District	Taluk	Taluk PDI mean	District meanPDI
1	Raichur	Raichur	44.00	39.60
		Deodurga	35.20	
2	Yadgir	Yadgir	13.33	15.60
		Shahapur	17.86	
3	Kalaburgi	Kalaburgi	23.46	23.06
		Aland	22.66	
4	Koppal	Koppal	42.93	54.40
		Kushtagi	65.86	
5	Ballari	Ballari	19.46	26.60
		Hagaribommanahalli	33.73	

and they reported different disease reactions during screening studies while working with onion purple blotch disease. But the results are in contrast with Kushal *et al.* (2015) who reported Bellary red, L-819 and Arka Kalyan as resistant for onion purple blotch with less incidence by screening onion varieties against purple blotch disease under field conditions. As per the literature Bheema Super and Arka Kalyan were registered as moderately resistant, but in our study Arka Kalyan showed moderately susceptible reaction to the purple blotch disease. Bheema Super showed moderately resistant reaction during field screening.

Survey in North Eastern Karnataka revealed that highest severity of purple blotch disease was noticed in fields of Garjinal village (86.40 %) in Koppal district and least severity of the disease was observed in Doranhalli village (9.60%) of Yadgir district. Maximum average disease severity of 54.40 per cent was noticed in Koppal district and lowest disease severity of 15.60 per cent was recorded in Yadgir district.

Table 3. Field screening of onion varieties against purple blotch disease during *kharif* 2016

Sl. No.	Varieties	PDI	Disease grade	Reaction
1	Arka Lalima	39.96	3	MS
2	Arka Kirthiman	36.72	3	MS
3	Arka Bheem	38.75	3	MS
4	Arka Niketan	39.85	3	MS
5	Arka Kalyan	38.65	3	MS
6	Bheema Shubra	28.79	3	MS
7	Bheema Shakti	18.92	2	MR
8	Bheema Kiran	34.97	3	MS
9	Bheema Red	40.00	3	MS
10	Bheema Swetha	38.68	3	MS
11	Bheema Super	19.80	2	MR
12	Bheema Dark Red	39.25	3	MS
13	Bheema Raj	36.82	3	MS
14	Arka Pragathi	39.72	3	MS
15	Bellary red (Susceptible check)	74.86	5	HS

- MR- Moderately resistant
- MS- Moderately Susceptible
- HS- Highly susceptible

Out of 15 screened onion varieties Bheema Shakti and Bheema Super were grouped to be moderately resistant with 18.92 per cent and 19.80 per cent disease severity respectively and twelve varieties viz., Arka Lalima, Arka Kirthiman, Arka Bheem, Arka Niketan, Arka Kalyan, Bheema Shubra, Bheema Kiran, Bheema Red, Bheema Swetha, Bheema Dark Red, Bheema Raj, Arka Pragathi were found to be moderately susceptible and Bellary red showed highly susceptible reaction with disease severity of 74.86 per cent. Mainly the inoculum load and environmental conditions might favoured the disease development and spread of the pathogen.

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