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Delineation of Purple Blotch Disease Hotspots Caused by *Alternaria porri* in Key Onion Cultivation Regions of Southern Karnataka, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Onion (*Allium cepa* L.) stands as a crucial bulb crop and a primary commercial vegetable crop in India. Among the various maladies affecting bulb and seed development, purple blotch, caused by *Alternaria porri,* stands out as one of the most devastating. This ailment inflicts extensive damage

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on both bulb and seed crops. Through an extensive roving survey, we have unveiled the disease's prevalence, enabling the identification of disease hotspots in the major onion cultivation regions of southern Karnataka. A total of 28 hotspot regions were identified in the eight districts surveyed for purple blotch disease severity in onions. Notably, the highest mean of percent disease index (PDI) was recorded in Chikkamagaluru (51.12%), while Chamarajanagara showed the lowest mean PDI (23.35%). Among all surveyed villages, the most severe disease prevalence was observed in Koverahatti village within Hiriyur taluk of Chitradurga district, with a PDI of 64.47%. On the other hand, the lowest disease severity was noted in Uttamballi village (16.89%) in Kollegala taluk, Chamarajanagara district.

Keywords: Onion; purple blotch; disease; percent disease index (PDI); Alternaria porri.

1. INTRODUCTION

The onion (*Allium cepa* L.) is a significant bulb crop within the Allium genus of the Alliaceae family. Throughout history, it has been a crucial vegetable crop that is widely cultivated and consumed across the globe. Its origin is believed to be in Central Asia. In India, the onion is affectionately referred to as the Queen of the Kitchen. According to the global onion production data, China emerged as the leading producer, accounting for 24.92 percent of the total production. India followed closely behind with 22.83 percent of the production, while the USA secured the third position with 3.17 percent of the production. Onion ranked second in terms of cultivation area and third in productivity. In India, onion is cultivated in an area approximately of 1.91 million hectares, resulting in a production of 31.27 million tons and a productivity rate of 16.30 MT per hectare, in Karnataka area under cultivation 0.23 million hectares, production 2.77 million tons and a productivity 11.99 MT during the 2021-22 period [1].

Onion is highly a export-oriented crop, playing a significant role in earning valuable foreign exchange for the country. Annually, India produces 55 to 60 lakh tons of onion, with 50 percent coming from *Rabi* onion harvested in April to May, 30 percent from late *Kharif* harvested in January to February and 20 percent from *Kharif* onion harvested in October to November. However, the productivity of *Kharif* onion is notably low, ranging from 10 to 12 t/ha [2]. The decline in onion bulb production can be attributed to several biological factors, including the deterioration of bulbs caused by increased respiration, rendering them unsuitable for marketing [3]. Among the biotic factors, diseases play a significant role in reducing the productivity and quality of onion. These diseases encompass foliar, bulb and root pathogens that negatively impact both yield and overall crop quality [4]. Several diseases, contribute to the low productivity of onion in India. Among these factors, diseases such as purple blotch, downy mildew, Stemphylium blight, basal rot and botrytis leaf blight.

The purple blotch of onion symptom starts with small, water soaked lesions approximately 2 to 3 mm in diameter that appears on the leaves or seed stalk of the onion. These lesions quickly turn brown and enlarge, forming zonate regions with a purplish color. The margin surrounding the lesion is purple or red, accompanied by a yellow halo that extends upward and downward. Infected bulb tissues eventually become papery, and Alternaria produces toxic metabolites within the host, which adversely affect seed germination and seedling vigor [5]. Purple blotch disease has significant yield losses up to 50 to 57 percent , even some times complete crop failure onion growing areas worldwide [6].

The first report of purple blotch disease in onion caused by *Alternaria cepulae* (Know: *A. porri)* was made by Ponnappa [7], the disease was observed at College of Agriculture Dharwad, Karnataka, during October 1953. Disease prevalence is still observed in major onion-growing areas, and the hotspots of disease-prone areas are identified in major onion-growing areas of Sothern Karnataka. A significant portion of onion cultivation takes place and the crop is heavily affected by this disease. Therefore, there is a need for roving surveys to assess the disease status and distribution.

2. MATERIALS AND METHODS

2.1 Survey on Severity of Purple Blotch of Onion in Major Onion Growing Areas of Southern Karnataka

A roving survey was conducted to assess the severity of purple blotch in onion during 2021,

2022 in different parts of Southern Karnataka in the farmers fields of Chikkamagaluru, Chitradurga, Davanagere, Tumakur, Chikkaballapur, Shivamogga, Uttara Kannada and Chamarajanagar. In each district, different villages were surveyed.

During survey data on district, taluk and village name, variety (Red/white), crop stage, acreage, irrigated or rainfed, soil type, percent disease index (%), other diseases observed, pests observed, GPS coordinates and previous crop history was collected.

Scoring of disease was done in the field by using 0 to 5 scale given by Mayee and Datar [8]. The Percent Disease Index (PDI) was calculated by using formula given by Wheeler [9].

"Percent disease index (PDI) =" "Sum of the individual disease ratings" /"Number of leaves scored x Maximum disease grade" "×100"

List 1. Scoring of disease

Grade	Disease scale	Description	Reaction
0	<5	No disease symptoms	Immune
1	5-10	A few spots towards tip covering 10 percent leaf area	Highly resistant
2	11-20	Several dark purplish brown patches up to 20 percent leaf area	Resistant
3	21-40	Several patches with pale outer zone up to 40 percent leaf area	Moderately resistant
4	41-60	Leaf streaks up to 75 percent leaf area	Susceptible
5	>60	Complete drying of the leaves or breaking of leaves from centre	Highly susceptible

2.2 Hotspot Areas

An intensive roving survey was done to know the hotspot areas for purple blotch of onion, where mean PDI was more than 50 %. Those areas are considered as the hotspot for purple botch of onion.

2.3 Statistical Analysis

In the present investigation, statistical analysis was done.

3. RESULTS

3.1 Survey on Severity of Purple Blotch of Onion in Major Onion Growing Areas of Southern Karnataka

From 2021 to 2022, an extensive roving survey was undertaken in major onion growing districts of Southern Karnataka for purple blotch disease severity in farmers fields. Each taluka encompassed one to ten villages, with one to six fields surveyed in each village. Within each field, ten plants were randomly chosen for disease assessment using the Mayee and Datar [8] disease rating scale (0-5).

Among the eight districts surveyed for the severity of purple blotch disease in onion the highest mean PDI was observed in Chikkamagaluru (51.12 %), while the lowest mean PDI was observed in Chamarajanagara (23.35 %) In terms of taluk wise analysis, the highest mean PDI was observed in Kadur (52.24 %) within the Chikkamagaluru district, and the lowest PDI was observed in Kollegala (23.35 %) taluk of Chamarajanagar district (Table 1).

Among all the surveyed villages, the highest disease severity was 64.47 percent PDI, observed in Koverahatti village in the Hiriyur taluk of the Chitradurga district. The least disease severity was observed in Uttamballi (16.89 %) village of Kollegala taluk in Chamarajanagara district (Fig. 1 and Table 1). The results obtained from this study are also in agreement with results on the status of disease across different onion growing districts of Karnataka made by Hariprasad and Palakshappa [10], roving survey results revealed the mean maximum severity in Gadag (55.91 %) followed by Chitradurga district (52.29 %), Padma *et al.* [11], disease severity in surveyed areas ranged from 9.60 to 86.40 percent . Ravichandran *et al.* [12] from the survey it was clear that the severity of this disease depends upon environmental conditions prevailing in different localities. Uttara Kannada district had more (69.33 PDI) incidence and severity of purple blotch.

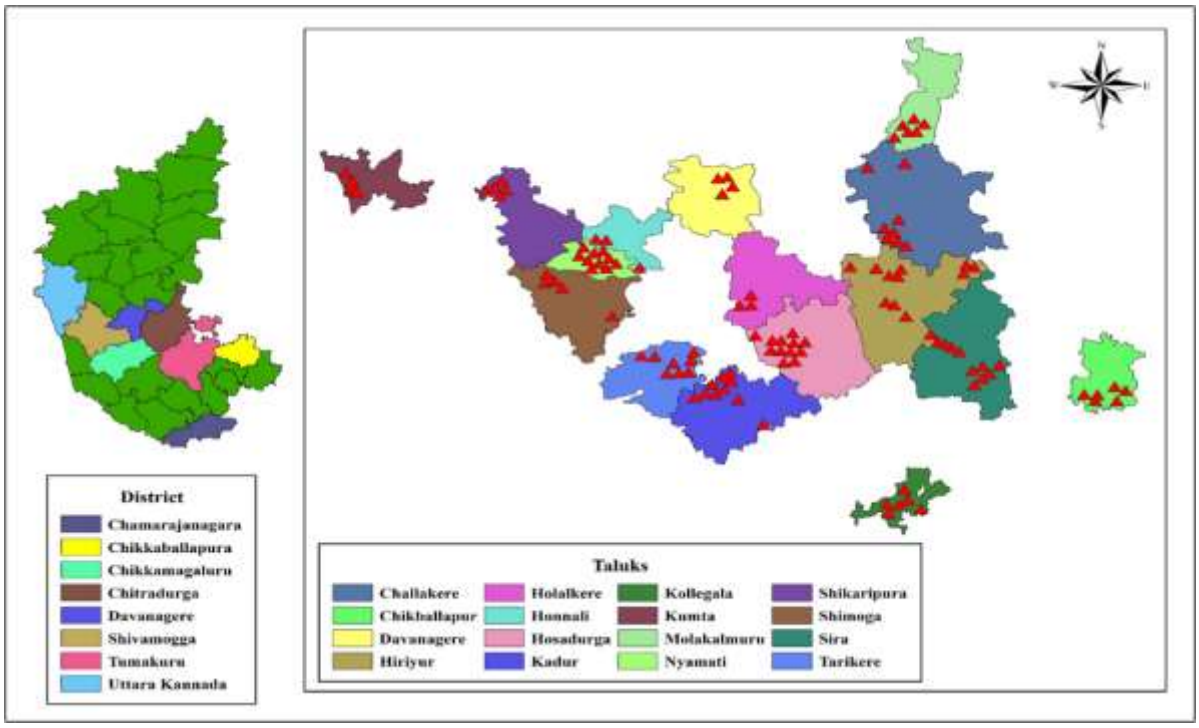

Fig. 1. Surveyed locations for severity of purple blotch of onion in major onion growing areas of Southern Karnataka

3.2 Hotspot Areas for Purple Blotch Disease of Onion

Survey on purple blotch disease of onion carried out during 2021 to 2022 provided an opportunity to identify the disease prone endemic areas in different districts of Southern Karnataka. Based on the survey results obtained, the villages *viz*., Birur (61.31 %), Dogihalli (52.24 %), Giriyapura (54.27 %), Biluvala (62.22 %), Hirenalluru (61.45 %) Ajjampura (56.17 %), Sokke (51.27 %), Makanahalli (59.91 %), Shivani (54.12 %), Bettadahalli (61.00 %), K. Hosuru (54.72 %) and Nagavangala (59.48 %) villages of Chikkamagaluru district. M G Dibba (58.19 %), Malali (61.95 %), Aralihalli (57.24 %), Kodihalli (52.90 %), Rayapura (54.76 %), B G Kere (51.45 %), Chikkobanahalli (57.75 %), Babbur (53.38 %), Harthikote (59.72 %), Koverahatti (64.47 %), Talavatti (59.18 %), Ramagiri (59.11 %), Talikatte (54.19 %) viallages of Chitradurga district. Rudranakatte (51.31 %), Madanabhavi (52.71 %) village of Davanagere ditrict and Dwaralu (57.66 %) village of Tumakuru district (Table 1). With more than 50 percent disease PDI were found to be the “hotspots” areas for purple blotch disease of onion the disease primarily spreads through airborne conidia and can persist in plant debris for upto 8 months. Additionally, it was also noticed that transmission can occur through contaminated seeds and bulbs so effectively restrict the disease from further spread, proper sanitation practices must be taken. These results in accordance with Hariprasad and Palakshappa [10], observed during roving survey, revealed the mean maximum severity in Gadag (55.91 %) followed by Chitradurga district (52.29 %). They found that the mean severity was more than 50 percent .

3.3 Variety, Variety Type and Crop Stage

During the survey, we noticed that in many onion-growing areas, farmers were mainly cultivating the local variety and almost all of the onions grown were the red type.

Purple blotch disease severity was observed mostly after 45 days of sowing and this disease is more prevalent after bulb initiation because the onion plant matures and focuses its energy on bulb formation, thus causing older leaves to senesce (wither and die). These older leaves are more susceptible to infection, and the disease tends to target them, leading to the characteristic purple blotch symptom. Alternaria is a low sugar pathogen it attracts the older leaves as there will be less nutrients in lower leaves are more prone to infection.

Table 1. Survey on percent disease severity of purple blotch of onion in major onion growing areas of Southern Karnataka during 2021/2022 growing season

District	Taluk	Village	Latitude	Longitude	Crop stage (days)	Other disease observed	Other pest observed	Previous crop history	Purple blotch (PDI)
1) Chikkamagaluru	**Kadur**	**Birur**	13°36'6.79N	75°57'31.42E	105	Smudge, SLB	Thrips	Onion	61.31
		Dogihalli	13°36'56.71N	75°58'46.15E	95	SLB, Smudge	Thrips	Onion	52.24
		Yarehalli	13°38'25.73N	75°58'57.03E	100	SLB, Smudge, DM	Thrips	Onion	44.57
		Somanahalli	13°28'36.03N	76° 9'46.30E	80	Smudge, SLB	Thrips	Brinjal	42.48
		Inglaranahalli	13°37'38.85N	75°58'11.85E	90	Smudge, Smut, BR	Thrips	Cucumber	39.40
		Giriyapura	13°41'15.66N	76° 2'45.84E	90	Smut, Smudge, BR	Thrips	Tomato	54.27
		Biluvala	13°34'46.28N	76° 4'28.50E	110	Smudge	Thrips	Onion	62.22
		Hirenalluru	13°40'13.82N	76° 2'21.33E	110	Smudge, SLB	Thrips	Brinjal	61.45
	Mean							**52.24**	
	Tarikere	**Samatala**	13°42'35.07N	75°51'49.14E	80	Smudge, BR, SLB	Thrips	Onion	38.28
		Thimmapura	13°45'10.35N	75°46'57.64E	95	Smudge, SLB	Thrips	Cotton	43.37
		Malalichannenhalli	13°45'19.23N	75°44'7.63E	105	SLB, onion twister	Thrips	Chilli	48.48
		Ajjampura	13°43'29.46N	76° 0'26.21E	110	Smudge, SLB	Thrips	Onion	56.71
		Sokke	13°42'57.32N	75°57'32.71E	100	Smudge	Thrips	Onion	51.27
		Makanahalli	13°42'57.94N	75°57'32.98E	110	Smudge, DM	Thrips	Beans	59.91
		Shivani	13°49'0.98N	76° 1'38.24E	95	Color rot, DM	Thrips	Brinjal	54.12
		Bettadahalli	13°41'35.58N	75°52'33.92E	110	SLB, Smudge	Thrips	Onion	61.00
		Koranahalli	13°41'22.49N	75°54'1.62E	70	DM, onion twister	Thrips	Beans	22.57
		K. Hosuru	13°42'16.16N	75°51'35.95E	95	SLB, Smudge	Thrips	Onion	54.72
		Nagavangala	13°39'36.71N	75°58'43.03E	105	Color rot, DM,	Thrips	Chilli	59.48
	Mean							**49.99**	
2) Chitradurga	**Hosadurga**	**M G Dibba**	13°46'09.39N	76°15'29.95E	110	Smudge, Smut, BR	Thrips	Groundnut	58.19
		K K Hatti	13°46'41.62N	76°15'27.89E	90	Smut, Smudge, BR	Thrips	Ragi	41.57

	Bokikere	13°46'53.57N	76°15'12.93E	75	Smudge	Thrips	Groundnut	38.76
	Peelapura	13°46'29.37N	76°13'27.61E	90	Smudge, SLB	Thrips	Maize	44.36
	Malali	13°45'39.97N	76°14'8.43E	115	Smudge, BR, SLB	Thrips	Groundnut	61.95
	Kanguvalli	13°43'35.89N	76°14'5.15E	95	SLB	Thrips	Ragi	48.57
	Nagnahalli	13°48'56.47N	76°13'33.16E	85	SLB	Thrips	Groundnut	43.48
	Baguru	13°48'59.08N	76°11'41.22E	90	SLB	Thrips	Onion	39.80
	Honnekere	13°48'14.73N	76°13'42.97E	80	SLB, Smudge	Thrips	Onion	49.78
	Aralihalli	13°53'27.50N	75°44'50.55E	100	Smudge, DM	Thrips	Maize	57.24
	Shivanekatte	13°48'19.12N	76°15'10.11E	80	Color rot, DM	Thrips	Ragi	44.57
	Kodihalli	13°47'15.26N	76°12'17.14E	95	Smudge, SLB, DM	Thrips	Groundnut	52.90
Mean								**48.43**
Challakere	**Chikkamadhure**	14°12'34.57N	76°36'29.73E	80	SLB, DM	Thrips	Maize	38.13
	Hiremadhure	14°13'0.94N	76°36'29.66E	75	SLB, Smudge	Thrips	Maize	36.39
	Chigatanahalli	14°12'36.82N	76°36'15.63E	85	Color rot, DM	Thrips	Onion	44.80
	Ganjigunte	14°12'47.29N	76°38'17.00E	90	Color rot, DM	Thrips	Onion	41.15
	Upparahatti	13°58'5.09N	76°35'39.56E	75	SLB	Thrips	Ragi	36.38
	Sanekere	14°11'35.75N	76°40'3.33E	60	SLB, DM	Thrips	Maize	32.45
	Khandenahally	14° 6'25.82N	76°54'18.79E	90	Smudge, SLB	Thrips	Maize	46.46
	Somagudda	14°18'2.10N	76°38'28.40E	85	Smudge, DM	Thrips	Maize	39.57
Mean								**39.42**
Molkalmuru	**Thumkurlahalli**	14°40'51.06N	76°39'30.47E	80	Smudge, DM	Thrips	Maize	44.14
	Konasagara	14°41'8.63N	76°44'5.03E	85	Smudge, DM	Thrips	Sorghum	49.42
	Rayapura	14°42'26.35N	76°41'53.87E	95	DM, Smudge	Thrips	Maize	54.76
	B G Kere	14°39'15.20N	76°40'39.15E	90	Smudge, SLB	Thrips	Sorghum	51.45
	Chikkobanahalli	14°39'34.68N	76°35'58.50E	105	SLB, Smudge	Thrips	Onion	57.75
	Hirehalli	14°31'39.59N	76°39'53.93E	80	SLB, Smudge, DM	Thrips	Maize	44.64
	Nerlahalli	14°39'20.02N	76°42'24.59E	85	Smudge, SLB	Thrips	Groundnut	49.23
Mean								**50.20**
Hiriyur	**Hosakere**	14° 4'58.35N	76°52'5.60E	75	Smudge, Smut, BR	Thrips	Chilli	38.32

		Hosakerepalya	14° 6'59.76N	76°52'38.21E	95	Smut, Smudge, BR	Thrips	Maize	48.67
		Babbur	13°57'23.25N	76°37'26.92E	105	Smudge	Thrips	Groundnut	53.38
		Harthikote	14° 4'16.15N	76°38'14.21E	100	Smudge, SLB	Thrips	Groundnut	59.72
		Koverahatti	14° 6'39.87N	76°28'12.72E	110	Smudge, BR, SLB	Thrips	Maize	64.47
		Talavatti	14° 6'16.42N	76°33'41.58E	95	DM, Smudge SLB	Thrips	Onion	59.18
		Mudiyappanakottige	14° 4'11.39N	76°37'40.80E	85	Smudge, BR, DM	Thrips	Onion	44.76
		Yaraballi	14° 6'1.81N	76°38'52.30E	95	Smudge, DM	Thrips	Maize	49.34
		Aimangla	14° 5'30.62N	76°32'5.59E	85	SLB, DM	Thrips	Maize	43.18
	Mean								**51.22**
	Holalkere	**Ramagiri**	13°57'27.29N	76° 7'19.17E	80	Smudge, DM	Thrips	Onion	59.11
		Talikatte	13°57'22.50N	76° 4'52.00E	95	Color rot, DM	Thrips	Maize	54.19
		Dasikatte	13°58'20.48N	76° 7'0.82E	60	Smudge, BR, SLB	Thrips	Maize	43.36
	Mean								**52.22**
3) Davanagere	**Davanagere**	**Sriramanagara**	14°28'34.31N	76° 0'51.94E	70	DM, Smudge, BR	Thrips	Tomato	43.24
		Tumbigere	14°26'57.14N	76° 2'31.80E	110	Smudge, BR, SLB	Thrips	Onion	38.58
		Lingapura	14° 6'41.42N	75°43'51.14E	100	Color rot, DM	Thrips	Onion	43.67
		Alur-hatti	14°28'44.36N	76° 1'14.61E	95	Color rot, DM	Thrips	Tomato	48.48
		Rudranakatte	14°26'23.02N	76° 2'38.27E	80	DM, SLB	Thrips	Tomato	51.31
	Mean								**45.06**
	Honnali	**Surahonne**	14° 8'34.48N	75°33'32.29E	95	DM, SLB	Thrips	Tomato	46.18
		Arundi	14°10'51.60N	75°33'57.11E	100	Smudge, SLB	Thrips	Beans	49.45
		Kenchikoppa	14°11'38.05N	75°33'35.36E	85	Smudge, DM	Thrips	Beans	44.63
		Thuggalahalli	14°12'14.02N	75°34'37.02E	80	Smudge, DM	Thrips	Onion	34.81
		Soratur	14°12'49.76N	75°35'28.99E	90	Smudge, DM	Thrips	Onion	33.20
	Mean								**41.65**
	Nyamthi	**Kodikoppa**	14° 7'39.31N	75°33'39.04E	110	DM, Smudge	Thrips	Beans	38.33
		Basavapura	14° 9'50.40N	75°34'53.70E	95	Smudge, SLB	Thrips	Beans	38.98
		Danahalli	14° 9'25.75N	75°35'14.97E	100	SLB, Smudge	Thrips	Onion	41.16
		Madanabhavi	14°10'45.73N	75°36'7.87E	85	SLB, Smudge, DM	Thrips	Chilli	52.71
		Doddethinahalli	14° 8'10.29N	75°35'33.94E	90	Smudge, SLB	Thrips	Onion	43.90

		Chikkethinahalli	14° 7'18.62N	75°34'52.83E	105	Smudge, Smut, BR	Thrips	Onion	32.20
		Arehalli	14° 9'2.09N	75°37'22.70E	95	Smut, Smudge, BR	Thrips	Tomato	39.41
	Mean								**40.96**
4) Tumakur	**Sira**	**Gollarahatti**	13°42'43.05N	76°59'31.07E	85	Smudge	Thrips	Ragi	31.29
		Kallambella	13°37'52.51N	76°54'55.03E	90	Smudge, SLB	Thrips	Groundnut	29.71
		Katanahalli	13°41'20.85N	76°53'43.43E	65	Smudge, BR, SLB	Thrips	Ragi	46.30
		Ajjayanapalya	13°45'56.31N	76°51'1.23E	75	SLB	Thrips	Onion	33.79
		Chikkanahalli	13°39'58.11N	76°55'28.67E	60	Smudge	Thrips	Groundnut	41.18
		Kadavigere	13°40'31.69N	76°55'37.33E	110	Smudge, BR, SLB	Thrips	Ragi	19.21
		Dwaralu	13°47'4.54N	76°49'22.06E	75	Smudge, DM	Thrips	Onion	57.66
		Thavarakere	13°47'51.05N	76°48'0.96E	80	Color rot, DM	Thrips	Groundnut	42.42
		Maranagere	13°48'31.11N	76°46'32.75E	95	Smudge	Thrips	Groundnut	37.00
		Ujjanakunate	13°50'9.14N	76°44'58.26E	85	SLB, Smudge	Thrips	Ragi	47.95
		Rayabommanahalli	13°54'36.86N	76°39'51.73E	100	SLB, Smudge	Thrips	Groundnut	42.08
	Mean								**38.80**
5) Chikkaballapur	**Chikkaballapur**	**Nayanhalli**	13°25'33.45N	77°46'29.44E	100	Smudge, DM	Thrips	Beans	34.75
		Muddnahalli	13°24'25.76N	77°41'40.28E	80	Smudge, DM	Thrips	Beans	29.93
		Kanivenarayanapura	13°24'25.09N	77°39'23.41E	95	SLB, Smudge	Thrips	Marrigold	36.31
		Varadahalli	13°26'11.12N	77°46'30.04E	100	Smudge, SLB	Thrips	Tomato	29.26
		Nandi	13°23'20.11N	77°41'51.52E	110	SLB, Smudge	Thrips	Tomato	31.39
		Ajjavara	13°24'47.25N	77°46'15.39E	75	SLB, Smudge, DM	Thrips	Beans	17.72
	Mean								**29.89**
6) Shivamogga	**Shivamogga**	**Kumsi**	14° 3'2.17N	75°23'50.65E	95	Color rot, DM	Thrips	Sugarcane	22.34
		Kempena koppa	14° 3'49.16N	75°23'50.34E	80	Color rot, DM	Thrips	Ragi	28.19
		Hubbana halli	14° 2'29.00N	75°25'1.91E	60	DM, SLB	Thrips	Hoursgram	31.56
		Chennadevana koppa	14° 1'56.01N	75°24'51.08E	45	DM, onion twister	Thrips	Rice	23.49
	Mean								**26.40**
	Shikaripura	**Devikoppa**	14°25'38.48N	75°13'4.87E	65	Smudge, SLB	Thrips	Chilli	33.48
		Javagatte	14°24'54.10N	75°13'32.90E	85	Smudge, DM	Thrips	Ragi	28.81
		Thandagunda	14°27'49.59N	75°12'19.97E	60	Smudge, DM	Thrips	Ginger	39.23
		Thathur	14°29'36.90N	75°11'55.49E	75	Smudge, DM	Thrips	Chilli	31.73
		Kodihalli	14°25'17.72N	75°11'33.98E	80	DM, Smudge	Thrips	Chilli	29.18

	Mean								**32.49**
7) Uttara Kannada	**Kumta**	**Holanagadde**	14°26'49.49N	74°22'54.75E	70	Color rot, DM	Thrips	Paddy	32.07
		Holegadde	14°21'59.06N	74°25'20.19E	70	DM, onion twister	Thrips	Paddy	23.51
		Dhareshwara	14°22'34.62N	74°24'32.73E	90	Smudge, SLB	Thrips	Groundnut	29.66
		Alavekodi	14°24'56.79N	74°24'11.05E	85	Smudge, DM	Thrips	Groundnut	19.16
	Mean								**26.55**
8) Chamarajanagara	**Kollegala**	**Thimmarajipura**	12° 6'14.50N	77° 8'8.59E	80	Smudge, SLB	Thrips	Marrigold	19.12
		Tellanur	12° 8'58.19N	77° 5'48.29E	85	Smudge, Smut, BR	Thrips	Beans	23.34
		Uttamballi	12° 8'26.28N	77° 4'43.05E	60	Smudge	Thrips	Tomato	16.89
		Kunthur	12° 7'35.79N	77° 1'0.75E	80	Smudge, SLB	Thrips	Tomato	29.65
		Kungalli	11°52'8.78N	77°55'0.52E	85	Smudge, BR, SLB	Thrips	Beans	23.30
	Mean								**23.35**

SLB: Stemphylium Leaf Blight, DM: Downy Mildew, BR: Basal Rot, PDI: Percent Disease Index

The survey findings also unveiled that the age of the plant could significantly impact the degree and intensity of damage caused by *A. porri,* disease prevalence and severity exhibited a lower occurrence in younger, robust plants, while older, senescing plants displayed highest vulnerability to the disease. The increased susceptibility of the host to Alternaria infection could potentially be attributed to factors such as a decrease in the thickness of the epicuticular wax layer [13] or a decline in alkaloid production [14], both of which tend to host susceptibility to Alternaria infection.

3.4 Irrigation and Soil Type

The survey findings have revealed that a significant portion of onion cultivation takes place under rainfed conditions. Additionally, a range of irrigation such as surface irrigation, sprinkler irrigation and drip irrigation, have been noticed. Notably, the majority of onion cultivation occurs in areas with black soil, which offers favorable conditions for onion growth due to its moisture retention and nutrient holding capacity, followed by red soil and there are some areas characterized by sandy soil.

3.5 Other Diseases And Pest Observed

Throughout the survey, the presence of several other minor diseases affecting onions, including Stemphylium blight, onion twister, smudge, downy mildew, smut and basal rot. These diseases can lead to varying degrees of damage, from foliar discolouration to bulb deterioration.

Additionally, the disease was observed more in the field where thrips damage was noticed, as thrips scrape and sucks the all the sap those plants much prone to get affected by purple blotch than healthy plants. Thrips was common pest that can cause significant damage to onion crops by feeding on plant tissues.

These observations similar with Tomaz and Lima [15] found even higher economic losses of approximately 80 to 85 percent due to purple blotch, in onion crop, when combined with Stemphylium blight and other diseases. Vinod Kumar [16] noted damage to bulbs and seed crops ranges from 25 to 90 percent when the disease coexists with Stemphylium blight.

3.6 Symptoms Observed During Survey

During survey various symptoms of the disease were noticed on leaves, flower stalk, inflorescence and, also, on bulbs. At initial stages, leaves have showed circular to oval, water-soaked areas that later on, became oblong and a fresh zone of discoloured tissue was formed around the spots. Initially spots were white, but later turned pinkish or purple surrounded by yellow halo. The change in colour started from the center and gradually progressed towards the periphery. The transition of colour was marked by concentric rings clearly visible to the naked eyes.

The older leaves were more susceptible than younger leaves and were relatively more susceptible when they reach close to bulb maturity. Similar lesions were formed on seed stalks of the inflorescence axis which caused girdling and in most cases resulted in the destruction of the stalk. As a result of this, seeds either did not develop or if developed, they were shriveled. The bulbs were also affected at harvest when the fungus entered through the neck or injury. Survey observation similar with Priya [17] recorded the appearance of small water soaked lesions on inoculated onion leaves, which later enlarged, became sunken and purplish, with a yellow halo. The complete expression of symptoms was observed after 60 days on inoculated plants. Abdel-Rahim *et al.* [18] noted lesions with typical symptoms of the disease were colonized by *A. porri.*

3.7 Hotspot Areas for Purple Blotch Disease of Onion

Survey on purple blotch disease of onion carried out during 2021 to 2022 provided an opportunity to identify the disease prone endemic areas in different districts of Southern Karnataka. Based on the survey results obtained, the villages *viz*., Birur (61.31 %), Dogihalli (52.24 %), Giriyapura (54.27 %), Biluvala (62.22 %), Hirenalluru (61.45 %) Ajjampura (56.17 %), Sokke (51.27 %), Makanahalli (59.91 %), Shivani (54.12 %), Bettadahalli (61.00 %), K. Hosuru (54.72 %) and Nagavangala (59.48 %) villages of Chikkamagaluru district. M G Dibba (58.19 %), Malali (61.95 %), Aralihalli (57.24 %), Kodihalli (52.90 %), Rayapura (54.76 %), B G Kere (51.45 %), Chikkobanahalli (57.75 %), Babbur (53.38 %), Harthikote (59.72 %), Koverahatti (64.47 %), Talavatti (59.18 %), Ramagiri (59.11 %), Talikatte (54.19 %) viallages of Chitradurga district. Rudranakatte (51.31 %), Madanabhavi (52.71 %) village of Davanagere ditrict and Dwaralu (57.66 %) village of Tumakuru district. With more than 50 percent disease PDI were

found to be the “hotspots” areas for purple blotch disease of onion the disease primarily spreads through airborne conidia and can persist in plant debris for upto 8 months. Additionally, it was also noticed that transmission can occur through contaminated seeds and bulbs so effectively restrict the disease from further spread, proper sanitation practices must be taken. These results in accordance with Hariprasad and Palakshappa [10], they have observed during roving survey, results revealed the mean maximum severity in Gadag (55.91 %) followed by Chitradurga district (52.29 %). They found that mean severity was more than 50 percent.

4. DISCUSSION

Among the eight districts surveyed, the highest mean PDI of disease severity caused by the purple blotch of onions was observed in Chikkamagaluru (51.12 %), while the lowest mean PDI was observed in Chamarajanagara (23.35 %). In terms of taluk wise analysis, the highest mean PDI was observed in Kadur (52.24 %) taluk of Chikkamagaluru district and the lowest PDI was observed in Kollegala (23.35 %) taluk of Chamarajanagar district. Among all the surveyed villages, the highest disease severity was 64.47 percent PDI, observed in Koverahatti village in the Hiriyur taluk of the Chitradurga district. The least disease severity was observed in Uttamballi (16.89 %) village, Kollegala taluk of the Chamarajanagara district. Hotspot regions were identified by considering a PDI threshold of over 50%, leading to the designation of 28 villages as hotspots for purple blotch disease in onions. These hotspot regions are characterized by higher pathogen inoculum density, primarily attributed to the monocropping practices of onions.

5. CONCLUSION

Random survey findings revealed the prevalence of the disease, facilitating the delineation of 28 disease-prone hotspots in the primary onion cultivation areas of Southern Karnataka. These hotspots are notably susceptible to substantial economic losses and crop failure due to the escalated pathogen inoculum density, primarily linked to monocropping practices. In the context of the eight surveyed districts, the highest mean Percent Disease Incidence (PDI) for purple blotch in onions was recorded in Chikkamagaluru at 51.12%, while the lowest mean PDI was identified in Chamarajanagara at 23.35%.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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