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RESEARCH PAPER

Severity and distribution of purple blotch in major garlic growing areas of northern Karnataka

K. N. VIJAYKUMAR[1], SHRIPAD KULKARNI[2], P.V. PATIL[1], T. R. SHASHIDHAR[3]AND D. N. KAMBREKAR[4]

[1]Department of Plant Pathology, [2]Directorate of Extension, [3]Department of Horticulture,
[4]Department of Agricultural Entomology,
University of Agricultural Sciences, Dharwad - 580 005, Karnataka, India
E-mail: vijaykn549@gmail.com

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Abstract: Purple blotch caused by *Alternaria porri* is the most destructive disease causing yield loss up to 20 to 60 per cent. Survey was conducted during the two consecutive years 2019-20 and 2020-21 in the major garlic growing districts of northern Karnataka to know the severity of disease.The highest mean per cent disease severity was observed in Dharwad district (22.78 and 24.81 PDI during *Kharif* 2019 and 2020; 27.80 and 26.46 PDI during *Rabi* 2019 and 2020 respectively). On contrary, minimum mean per cent disease severity was noticed in Gadag district (14.95 and 17.43 PDI during *Kharif* 2019 and 2020; 17.40 and 20.18 PDI during *Rabi* 2019 and 2020 respectively).However, the higher severity of disease was noticed in *Rabi* (24.80 and 24.28 PDI) compared to *Kharif* season(19.34 and 20.64 PDI) during 2019 and 2020, respectively. Irrespective of the seasons and years, disease severity was more severe in the fields of black soil and irrigated condition when compared to red soil and rainfed condition.

Key words: *Alternaria porri*, Per cent disease index, Survey, Thrips

Introduction

Garlic (*Allium sativum* L.) is an herbaceous annual bulbous plant in the family Amaryllidaceae grown for its pungent and edible bulb. The origin of garlic dates back from 5000 to 6000 years. It is native to Central Asia and North-Eastern Iran. It has been utilized globally for thousands of years as both food and medicine. It is core ingredient of Mediterranean region and used very frequently in Asian, African and European cooking. It is considered as force of both good and evil (Parle and Vaibhav, 2007). It is vegetatively propagated by cloves or bulbils. Garlic bulb comprises of water (84.09 %), organic matter (13.38 %) and inorganic matter (1.53 %) along with 0.1 per cent volatile oil. The bulbs contain a colourless, odourless and water soluble compound called allicin. All parts of the garlic plant are edible, but fresh leaves and dried cloves are the parts mostly used in cooking. Important garlic growing countries are China, India, Bangladesh, Egypt, South Korea, Russian Federation, Ukraine, Spain, Uzbekistan and Myanmar. USA is said to be the world's largest import market of fresh garlic. India is the second largest garlic producing country after China with the production of 31.22 lakh tonnes from 3.85 lakh hectares area with an average productivity of 8.10 t ha^{-1}. In India, major garlic producing states are Madhya Pradesh, Gujarat, Uttar Pradesh, Rajasthan, Assam, Punjab and Maharashtra (Anon, 2021). There is constant demand of garlic in the market as it is required daily in small quantity in almost all houses. The garlic crop is cultivated in several countries and since it is propagated vegetatively, susceptible to number of diseases at various stages of plant growth. Among them purple blotch caused by *Alternaria porri* (Ellis) Ciferri, is the most destructive disease of *Allium* spp. (onion, garlic, shallots, leeks, scallions and chives). The disease is severe in high humidity of 80-90 per cent and moderate temperature of 25-30 °C. Significant reduction in bulb yield (25-60 %) due to drying of leaves has been observed in garlic (Bisht and Agarwal, 1993).Purple blotch initially starts as numerous tiny, white, circular or irregular spots, less than one millimetre diameter. These spots gradually increase in size, become oval-shaped or irregular and white coloured spot eventually changing to violet colour. Later stages of development show the central portion of the spots changing to purple, surrounded by a pale yellow orange to salmon band beyond which is a pale green zone. The dark purple colour is the most distinctive symptom of the disease. A distinct yellowing usually extends from both ends of the spots, often reaching the tips and basesof the leaves (Aveling, 1998). The production and productivity of garlic in India are very low compared to many other countries.

Purple blotch considered as a minor disease of garlic earlier, but its severity has increased at an alarming rate in the recent past, particularly in major garlic growing districts of northern Karnataka. In spite of its destructive nature, not much research work has been done on different aspects of the disease. By taking all the facts under consideration an attempt was made to survey for the severity of purple blotch in northern Karnataka during *Kharif* and *Rabi* 2019-20 and 2020-21.

Material and methods

In the present study, intensive roving survey was carried out in the parts of Bagalkote, Belagavi, Dharwad, Gadag, Haveri and Vijayapura districts of Karnataka during August-September and January-February 2019-20 and 2020-21. The individual fields were visited and observations were recorded as per the following format. During the survey garlic fields were observed for purple blotch severity, soil type, stage of the crop and other details were recorded.In each field, five blocks of one m^2 area were randomly selected and purple blotch severity was recorded by following 0-5 scale (Sharma, 1986) through visual observations as given below.

Disease scale (0-5 grade) for purple blotch of garlic (Sharma, 1986)

Score	Per cent leaf area infected
0	No disease symptoms
1	A few spots towards tip covering 10 per cent leaf area
2	Several dark purplish brown patches covering 11 to 20 per cent leaf area
3	Several patches with pale outer zone covering 21 to 40 per cent leaf area
4	Yellow streaks covering 41 to 75 per cent leaf area
5	Complete drying of the leaves or breaking of leaves from centre

Percent Disease Index (PDI) was calculated as per the formula given by Wheeler (1969).

$$PDI = \frac{\text{Sum of individual disease ratings}}{\text{Total no. of leaves graded} \times \text{Maximum disease rating}} \times 100$$

Results and discussion

A roving survey was undertaken during both *Kharif* (August and September) and *Rabi* seasons (December and January) of 2019 and 2020 to assess the severity of purple blotch in major garlic growing areas of Bagalkote, Belagavi, Dharwad, Gadag, Haveri and Vijayapura districts of Northern Karnataka. Along with disease severity other parameters like soil type, crop grown condition, stage of the crop, genotype, other diseases and insect pests were also tabulated (Table 1, 2, 3 and 4).

Severity of purple blotch during *Kharif* 2019

Totally 47 villages of 12 taluks and 6 districts were surveyed during *Kharif*, 2019. Maximum mean per cent disease severity was observed in Dharwad district (22.78 PDI) whereas, minimum mean per cent disease severity was noticed in Gadag district (14.95 PDI) (Table 1 and 5).

Highest severity of purple blotch (23.67 PDI) was recorded in Varchagal village of Mudhol taluka in Bagalkote district followed by Kulali village with severity of 24.44 PDI whereas, least disease severity (20.12 PDI) was recorded in Marikatti village.

In Belagavi district, three taluks were surveyed *viz*., Savadatti, Ramdurg and Bailhongal. In Savadatti taluka, the higher severity of purple blotch (26.16 PDI) was recorded in Chachadi followed by Itnal village with a severity of 24.47 PDI. However, the least severity (13.37 PDI) was recorded in Mutavada village of Savadatti taluka. Similarly in Ramdurg taluka, the maximum severity (25.43 PDI) was recorded in Ghatakanuru followed by Hampiholi with the severity of 15.92 PDI. The least severity (9.86 PDI) was recorded in Bhagojikoppa village. In Bailhongal taluka, the maximum severity (25.74 PDI) was recorded in Hanabaratti followed by Gajamanala with the severity of 22.67 PDI. The least severity (11.24 PDI) was observed in Chivutagundi. Among the taluks surveyed in Belagavi district, the maximum mean disease severity (20.76 PDI) was recorded in Bailhongal taluka followed by Savadatti taluka (20.44 PDI).

In Kundgol taluka of Dharwad district, the maximum severity of purple blotch (25.36 PDI) was recorded in Gudageri followed by Pashupatihala village with a severity of 22.53 PDI whereas, least severity (12.96 PDI) was recorded in Mandiganala village. Similarly in Dharwad taluk, the maximum severity (30.65 PDI) was recorded in Chandanamatti village. The least severity (22.34 PDI) was recorded in Benakanamatti. Among the taluks surveyed in Dharwad district, the maximum mean disease severity (26.18 PDI) was recorded in Dharwad taluka and the least mean disease severity was recorded in Kundgol taluka (19.38 PDI).

In Gadag taluka of Gadag district, the maximum severity of purple blotch (25.45 PDI) was recorded in Lingadala and least severity (10.57 PDI) was recorded in Belahoda village. Similarly in Lakshmeshwar taluka, the maximum severity (20.13 PDI) was recorded in Adrakatti whereas the minimum severity of 7.87 per cent was recorded in Ramageri. Among the taluks surveyed in Gadag district, maximum mean disease severity (17.13 PDI) was recorded in Gadag taluka and the least mean disease severity was in Lakshmeshwar taluka (12.78 PDI).

In Ranebennur taluka of Haveri district, the maximum severity of purple blotch (23.23 PDI) was recorded in Hediyala followed by Lingadahalli village with severity of 23.21 PDI. The least severity (13.68 PDI) was recorded in Chikkamaganura. Similarly in Byadgi taluka, the maximum severity (22.46 PDI) was recorded in Malluru village. The least severity (9.21 PDI) was recorded in Belakeri. Among the taluks surveyed in Haveri district, the maximum mean disease severity (20.07 PDI) was recorded in Ranebennur taluka and the least mean disease severity was recorded in Byadgi taluka (14.76 PDI).

In Vijayapura district, two taluks were surveyed, *viz*., Basavana Bagewadi and Muddebihal. In Basavana Bagewadi taluka, the highest severity of purple blotch (29.24 PDI) was recorded in Ingaleshwara followed by Ambalanura village with severity of 20.65 PDI. The least severity (16.97 PDI) was recorded in Kanakala village. Similarly in Muddebihal taluka, the maximum severity (25.83 PDI) was recorded in Alakoppa village. The least severity (17.05 PDI) was recorded in Chondi. Among the taluks surveyed in Vijayapura district, the maximum mean disease severity (21.25 PDI) was recorded in Basavana Bagewadi taluka followed by Muddebihal taluka (21.11 PDI).

Severity of purple blotch during *Rabi* 2019

Totally 49 villages of 12 taluks and 6districts were surveyed during *Rabi*, 2019. Maximum mean per cent disease severity was observed in Dharwad district (27.80 PDI) whereas, minimum mean per cent disease severity was noticed in Gadag district (17.40 PDI) (Table 2 and 6).

In Bagalkote district, two taluks were surveyed, *viz*., Bagalkote and Mudhol. In Bagalkote taluka, the highest severity of purple blotch (28.67 PDI) was recorded in Chitaginakoppa. The least severity (17.66 PDI) was recorded in Thimmapura village. Similarly in Mudhol taluka, the highest severity of purple blotch (35.12 PDI) was recorded in Melligeri followed by Jeeragala village with severity of 31.45 PDI. The least severity (16.56 PDI) was recorded in Channala village. Among the taluks surveyed in Bagalkote district, the maximum mean disease severity (26.45 PDI) was recorded in Mudhol taluka followed by Bagalkote taluka (22.22 PDI).

In Belagavi district, three taluks were surveyed *viz*., Savadatti, Ramdurg and Bailhongal. In Savadatti taluka, the higher severity of purple blotch (28.34 PDI) was recorded in Chikkumbi followed by Gontamara village with severity of 24.32 PDI. The least severity (19.67 PDI) was recorded in Chachadi village. Similarly in Ramdurg taluka, the maximum severity (27.33 PDI) was recorded in Murakatnal followed by Heerekoppa with the severity of 26.86 PDI. The least severity (17.92 PDI) was recorded in Kunnala village. In Baihongal taluka, the maximum severity (35.44 PDI) was recorded in Chivutagundi followed by Mattikoppa with the severity of 27.44 PDI. The least severity (18.89 PDI) was observed in Ujjanatti. Among the taluks surveyed in Belagavi district, the maximum mean disease severity (24.86 %) was recorded in Bailhongal taluka and the least mean disease severity was recorded in Ramdurg taluka (22.97 PDI).

In Kundgol taluka of Dharwad district, the maximum severity of purple blotch (34.33 PDI) was recorded in Chikkagunjala followed by Sultanapura village with severity of 28.21 PDI. The least severity (20.86 PDI) was recorded in Chikkanarti.

In Lakshmeshwar taluka of Gadag district, the maximum severity of purple blotch (23.89 PDI) was recorded in Ramageri followed by Kundralli village with severity of 18.67 PDI. The least severity (9.63 PDI) was recorded in Adrakatti.

In Ranebennur taluka of Haveri district, the maximum severity of purple blotch (42.67 PDI) was recorded in Lingadahalli followed by Benakanakonda village with severity of 37.21 PDI. The least severity (28.89 PDI) was recorded in Magoda. Similarly in Byadgi taluka, the

Table 1. Survey on severity of garlic purple blotch in northern parts of Karnataka during *Kharif* 2019

Districts	Taluks	Villages	Soil type	Crop grown condition	Stage of the crop (DAS)	Genotype	PDI	Other diseases observed	Insect pests
Bagalkote	Mudhol	Melligeri	Black	Rainfed	Bulb initiation	Local	21.25	-	Cutworms
		Kulali	Black	Rainfed	Bulb maturity	Local	22.44	-	-
		Varchagal	Black	Rainfed	Bulb maturity	Local	23.67	-	-
		Marikatti	Black	Irrigated	Bulb initiation	Local	20.12	-	-
			Taluka mean				21.87		
			District mean				21.87		
Belagavi	Savadatti	Mutavada	Black	Rainfed	Bulb initiation	Local	13.37	CLS	-
		Chachadi	Black	Rainfed	Bulb maturity	Local	26.16	-	Cutworms
		Itnal	Red	Irrigated	Bulb maturity	Local	24.47	-	Semiloopers
		Mugalihala	Black	Rainfed	Bulb initiation	Local	16.35	-	Cutworms
			Taluka mean				20.44		
	Ramdurg	Bhagojikoppa	Black	Irrigated	Bulb initiation	Local	9.86	CLB	-
		Hampiholi	Black	Rainfed	Bulb initiation	Local	15.92	-	-
		Ghatakanuru	Black	Rainfed	Bulb maturity	Local	25.43	-	-
		Chilamura	Black	Rainfed	Bulb maturity	Local	14.23	CLS	-
			Taluka mean				16.36		
	Bailhongal	Hanabaratti	Black	Rainfed	Bulb initiation	Local	25.74	-	-
		Gajamanala	Black	Rainfed	Bulb initiation	Local	22.67	CLS	Semiloopers
		Chivutagundi	Red	Rainfed	Bulb maturity	Local	11.24	CLB	Cutworms
		Yaragoppa	Black	Rainfed	Bulb maturity	Local	23.40	-	-
			Taluka mean				20.76		
			District mean				19.19		
Dharwad	Kundgol	Gudgeri	Black	Rainfed	Bulb maturity	Local	25.36	-	-
		Harlapura	Black	Rainfed	Bulb initiation	Local	15.48	CLS	Cutworms
		Hiregunjala	Black	Rainfed	Bulb initiation	Local	20.57	-	-
		Mandiganala	Black	Rainfed	Bulb maturity	Local	12.96	CLS	-
		Pashupatihala	Black	Irrigated	Bulb maturity	Local	22.53	-	Cutworms
			Taluka mean				19.38		
	Dharwad	Benakanamatti	Black	Rainfed	Bulb maturity	Local	22.34	-	Cutworms
		Chandanamatti	Black	Irrigated	Bulb maturity	Local	30.65	-	-
		Kabbenura	Black	Rainfed	Bulb maturity	Local	25.54	CLS	-
			Taluka mean				26.18		
			District mean				22.78		
Gadag	Gadag	Hirehandigo	Black	Rainfed	Bulb maturity	Local	15.36	-	Semiloopers
		Lingadala	Black	Rainfed	Bulb maturity	Local	25.45	-	-
		Belahoda	Black	Rainfed	Bulb initiation	Local	10.57	-	-
				Taluka mean			17.13		
	Lakshmeshwar	Adrakatti	Black	Rainfed	Bulb maturity	Local	20.13	-	-
		Ramageri	Black	Rainfed	Bulb initiation	Local	7.87	-	-
		Sankadala	Black	Rainfed	Bulb maturity	Local	10.33	-	-
			Taluka mean				12.78		
			District mean				14.95		
Haveri	Ranebennur	Chikkamaganura	Black	Rainfed	Bulb maturity	Local	13.68	-	-
		Antaravalli	Red	Rainfed	Bulb maturity	Local	22.23	-	Cutworms
		Lingadahalli	Black	Irrigated	Bulb maturity	Local	23.21	-	-
		Veerapura	Red	Irrigated	Bulb initiation	Local	20.63	-	-
		Sunakalabidari	Black	Rainfed	Bulb initiation	Local	16.44	-	-
		Hediyala	Black	Rainfed	Bulb maturity	Local	23.23	-	-
			Taluka mean				20.07		
	Byadgi	Malluru	Black	Rainfed	Bulb maturity	Local	22.46	-	-
		Belakeri	Black	Rainfed	Bulb initiation	Local	9.21	-	-
		Kadaramandalagi	Black	Irrigated	Bulb initiation	Local	11.94	-	-
		Angaragatti	Black	Rainfed	Bulb maturity	Local	15.41	-	-
			Taluka mean				14.76		
			District mean				17.41		
Vijayapura	Basavana Bagewadi	Ingaleshwara	Black	Irrigated	Bulb maturity	Local	29.24	-	-
		Ambalanura	Black	Irrigated	Harvesting	Local	20.65	-	-
		Kanakala	Black	Rainfed	Bulb maturity	Local	16.97	CLS	-
		Byakoda	Black	Rainfed	Bulb maturity	Local	18.15	-	-
			Taluka mean		21.25				
	Muddebihal	Rudagi	Black	Rainfed	Bulb maturity	Local	20.45	-	-
		Alakoppara	Black	Irrigated	Harvesting	Local	25.83	-	-
		Chondi	Black	Rainfed	Bulb initiation	Local	17.05	-	-
			Taluka mean				21.11		
			District mean				21.18		

CLS - Cercospora Leaf spot CLB - Colletotrichum leaf blight

Table 2. Survey on severity of garlic purple blotch in northern parts of Karnataka during *Rabi* 2019

Districts	Taluks	Villages	Soil type	Crop grown condition	Stage of the crop (DAS)	Genotype	PDI	Other diseases	Insect pests
Bagalkote	Bagalkote	Chitaginakoppa	Black	Irrigated	Bulb maturity	Local	28.67	SLB	Thrips
		Hiresanshi	Black	Irrigated	Bulb maturity	Local	20.33	-	Thrips
		Thimmapura	Red	Irrigated	Bulb initiation	Local	17.66	-	-
	Taluka mean	22.22							
	Mudhol	Channala	Black	Irrigated	Bulb maturity	Local	16.56	-	-
		Melligeri	Black	Irrigated	Harvesting	Local	35.12	SLB	Thrips
		Kulali	Black	Irrigated	Bulb maturity	Local	22.67	SLB	-
		Jeeragala	Black	Irrigated	Bulb maturity	Local	31.45	-	Thrips
			Taluka mean				26.45		
			District mean				24.34		
Belagavi	Savadatti	Chachadi	Black	Irrigated	Bulb maturity	Local	19.67	-	-
		Gontamara	Black	Irrigated	Bulb maturity	Local	24.32	-	Thrips
		Dundanakoppa	Red	Irrigated	Bulb maturity	Local	19.78	-	-
		Chikkumbi	Black	Irrigated	Bulb maturity	Local	28.34	SLB	Thrips
			Taluka mean				23.03		
	Ramdurg	Heerekoppa	Black	Irrigated	Harvesting	Local	26.86	-	-
		Kunnala	Black	Irrigated	Bulb maturity	Local	17.92	-	Thrips
		Murakatnal	Black	Irrigated	Harvesting	Local	27.33	-	-
		Hampiholi	Black	Irrigated	Bulb initiation	Local	19.78	-	-
			Taluka mean				22.97		
	Bailhongal	Chivutagundi	Black	Irrigated	Harvesting	Local	35.44	-	Thrips
		Ujjanatti	Black	Irrigated	Bulb maturity	Local	18.89	SLB	-
		Govanakoppa	Red	Irrigated	Bulb maturity	Local	19.23	SLB	-
		Mattikoppa	Black	Irrigated	Bulb maturity	Local	27.44	-	-
		Bairanatti	Black	Irrigated	Bulb maturity	Local	23.32	-	Thrips
			Taluka mean				24.86		
			District mean				23.62		
Dharwad	Kundgol	Sultanapura	Black	Irrigated	Bulb maturity	Local	28.21	SLB	Thrips
		Chikkanarti	Black	Irrigated	Bulb initiation	Local	20.86	-	-
		Chikkagunjala	Black	Irrigated	Bulb maturity	Local	34.33	-	Thrips
			Taluka mean				27.80		
			District mean				27.80		
Gadag	Lakshmeshwar	Ramageri	Black	Irrigated	Bulb maturity	Local	23.89	-	Thrips
		Adrakatti	Black	Irrigated	Bulb initiation	Local	9.63	-	-
		Kundralli	Black	Rainfed	Bulb maturity	Local	18.67	-	-
			Taluka mean				17.40		
			District mean				17.40		
Haveri	Ranebennur	Antaravalli	Red	Irrigated	Bulb maturity	Local	35.18	-	Thrips
		Lingadahalli	Black	Irrigated	Harvesting	Local	42.67	-	Thrips
		Asundi	Black	Irrigated	Bulb maturity	Local	36.12	-	Thrips
		Magoda	Black	Irrigated	Bulb maturity	Local	28.89	-	Thrips
		Devagondanakatti	Red	Irrigated	Bulb maturity	Local	31.44	-	-
		Benakanakonda	Black	Irrigated	Bulb maturity	Local	37.21	-	-
			Taluka mean				35.25		
Haveri	Byadgi	Belakeri	Black	Irrigated	Bulb maturity	Local	26.67	-	-
		Tadasa	Black	Irrigated	Bulb initiation	Local	17.11	-	Thrips
		Angaragatti	Black	Irrigated	Bulb maturity	Local	14.33	-	-
	Taluka mean	19.37							
	Rattihalli	Kudupali	Black	Irrigated	Bulb maturity	Local	20.21	-	-
		Kirageri	Black	Irrigated	Bulb maturity	Local	32.33	-	-
		Yaliwala	Black	Irrigated	Harvesting	Local	26.33	-	Thrips
		Malagi	Black	Irrigated	Bulb maturity	Local	29.21	-	Thrips
		Lingadevarakoppa	Black	Irrigated	Bulb maturity	Local	22.22	-	-
			Taluka mean				26.06		
			District mean				26.89		
Vijayapura	Basavana	Ingaleshwara	Black	Irrigated	Bulb maturity	Local	29.33	-	Thrips
	Bagewadi	Ivanagi	Black	Irrigated	Bulb maturity	Local	17.43	-	-
		Uthnala	Black	Irrigated	Bulb maturity	Local	22.12	-	-
		Sankanala	Black	Irrigated	Bulb maturity	Local	23.45	-	Thrips
		Byakoda	Black	Irrigated	Harvesting	Local	26.14	-	-
			Taluka mean				23.69		
	Muddebihal	Cheluvi	Black	Irrigated	Harvesting	Local	29.32	-	-
		Kamadinni	Black	Irrigated	Bulb maturity	Local	28.11	-	-
		Amaragola	Black	Irrigated	Harvesting	Local	34.21	-	Thrips
		Alakoppara	Black	Irrigated	Bulb maturity	Local	22.45	-	Thrips
			Taluka mean				28.52		
			District mean				26.11		

SLB - Stemphylium leaf blight

Table 3. Survey on severity of garlic purple blotch in northern parts of Karnataka during *Kharif* 2020

Districts	Taluks	Villages	Soil type	Crop grown condition	Stage of the crop	Genotype	PDI	Other diseases	Insect pests
Bagalkote	Mudhol	Shirol	Black	Rainfed	Bulb initiation	Local	13.15	-	Semiloopers
		Gulagala	Black	Rainfed	Bulb maturity	Local	18.32	CLS	-
		Lakkanatti	Black	Rainfed	Bulb initiation	Local	10.72	-	Cutworms
		Channala	Black	Rainfed	Bulb maturity	Local	23.54	-	-
			Taluka mean				16.43		
			District mean				16.43		
Belagavi	Savadatti	Mugalihala	Black	Irrigated	Bulb maturity	Local	19.17	-	-
		Sutagatti	Black	Rainfed	Bulb maturity	Local	24.56	-	Cutworms
		Chikkumbi	Black	Rainfed	Harvesting	Local	25.78	CLB	-
		Tadasalura	Red	Rainfed	Bulb maturity	Local	13.23	-	-
			Taluka mean				20.69		
	Ramdurg	Chilamura	Black	Irrigated	Bulb maturity	Local	23.67	-	Cutworms
		Murakatnal	Black	Rainfed	Bulb maturity	Local	19.46	CLS	-
		Budnikhurda	Black	Rainfed	Bulb maturity	Local	23.33	-	-
			Taluka mean				22.15		
	Bailhongal	Kalakuppi	Black	Irrigated	Bulb maturity	Local	26.43	-	Cutworms
		Ujjanatti	Black	Rainfed	Harvesting	Local	29.13	CLB	Cutworms
		Govanakoppa	Red	Irrigated	Bulb initiation	Local	21.28	-	-
		Hannikeri	Black	Irrigated	Bulb maturity	Local	22.11	-	-
			Taluka mean				24.74		
			District mean				22.53		
Dharwad	Kundgol	Ingalagi	Black	Irrigated	Bulb maturity	Local	28.62	-	Cutworms
		Kalasa	Black	Rainfed	Harvesting	Local	22.78	-	-
		Mandiganala	Black	Rainfed	Bulb maturity	Local	21.67	-	-
		Nelagudda	Black	Rainfed	Bulb initiation	Local	13.61	CLS	Semiloopers
			Taluka mean				21.67		
	Dharwad	Hangaraki	Black	Rainfed	Bulb maturity	Local	32.45	CLS	Cutworms
		Kabbenura	Black	Rainfed	Bulb maturity	Local	21.12	-	Cutworms
		Karadigudda	Black	Rainfed	Harvesting	Local	25.89	-	-
		Uppinabetageri	Black	Irrigated	Bulb maturity	Local	32.34	-	-
			Taluka mean				27.95		
			District mean				24.81		
Gadag	Gadag	Benakoppa	Black	Rainfed	Bulb maturity	Local	13.15	-	-
		Chinchali	Black	Rainfed	Bulb maturity	Local	24.67	-	-
		Binkadakatti	Black	Rainfed	Bulb initiation	Local	16.67	-	-
			Taluka mean				18.16		
	Lakshmeshwar	Ramageri	Black	Rainfed	Bulb maturity	Local	20.33	-	-
		Yalavatti	Black	Rainfed	Bulb maturity	Local	9.90	-	-
		Madalli	Black	Irrigated	Bulb maturity	Local	22.36	-	-
		Suranagi	Black	Irrigated	Bulb maturity	Local	14.16	-	-
			Taluka mean				16.69		
			District mean				17.43		
Haveri	Ranebennur	Antaravalli	Red	Irrigated	Bulb maturity	Local	21.56	-	Cutworms
		Lingadahalli	Black	Irrigated	Bulb maturity	Local	32.68	-	-
		Halageri	Black	Rainfed	Bulb maturity	Local	28.11	-	-
		Itagi	Black	Rainfed	Bulb initiation	Local	12.34	CLS	-
		Harogoppa	Black	Rainfed	Bulb maturity	Local	19.34	-	-
		Billalli	Red	Rainfed	Harvesting	Local	20.13	-	-
			Taluka mean				22.36		
	Byadgi	Alalageri	Black	Irrigated	Harvesting	Local	26.45	-	-
		Belakeri	Black	Rainfed	Bulb maturity	Local	14.13	-	-
		Shivapura	Black	Rainfed	Bulb initiation	Local	10.94	-	-
			Taluka mean				17.17		
			District mean				19.77		
Vijayapura	Basavana Bagewadi	Ingaleshwara	Black	Irrigated	Bulb maturity	Local	28.45	-	-
		Nagavada	Black	Rainfed	Bulb maturity	Local	12.11	-	-
		Uppaladinni	Black	Irrigated	Bulb initiation	Local	21.67	-	-
		Nagura	Black	Rainfed	Bulb maturity	Local	25.14	CLS	-
			Taluka mean				21.84		
	Muddebihal	Rudagi	Black	Irrigated	Bulb initiation	Local	8.62	-	-
		Alakoppara	Black	Rainfed	Harvesting	Local	27.34	CLS	-
		Kalagi	Black	Rainfed	Bulb maturity	Local	17.45	-	-
			Taluka mean				17.80		
			District mean				19.82		

CLS - Cercospora Leaf spot CLB - Colletotrichum leaf blight

Table 4. Survey on severity of garlic purple blotch in northern parts of Karnataka during *Rabi* 2020

Districts	Taluks	Villages	Soil type	Crop grown condition	Stage of the crop (DAS)	Genotype	PDI	Other diseases	Insect pests
Bagalkote	Bagalkote	Mugalolli	Black	Irrigated	Bulb maturity	Local	24.12	-	-
		Hirehodlura	Black	Irrigated	Bulb maturity	Local	19.78	-	Thrips
		Ankalagi	Red	Irrigated	Bulb maturity	Local	18.32	SLB	-
			Taluka mean				20.74		
	Mudhol	Kulali	Black	Irrigated	Bulb maturity	Local	28.53	-	-
		Shirol	Black	Irrigated	Harvesting	Local	34.67	-	Thrips
		Chaudapura	Black	Irrigated	Bulb maturity	Local	21.12	-	-
		Dadanatti	Black	Irrigated	Bulb maturity	Local	19.76	SLB	-
			Taluka mean				26.02		
			District mean				23.38		
Belagavi	Savadatti	Mugalihala	Red	Irrigated	Bulb maturity	Local	20.41	-	-
		Bhamagundikoppa	Black	Irrigated	Bulb maturity	Local	28.12	-	Thrips
		Gontamara	Black	Irrigated	Bulb maturity	Local	18.33	-	-
		Inchala	Black	Irrigated	Harvesting	Local	31.14	-	-
			Taluka mean				24.50		
	Ramdurg	Heerekoppa	Black	Irrigated	Bulb maturity	Local	29.21	SLB	-
		Chippalakatti	Black	Irrigated	Bulb maturity	Local	19.67	-	-
		Bhagojikoppa	Black	Irrigated	Bulb maturity	Local	24.43	-	Thrips
			Taluka mean				24.44		
	Bailhongal	Hanabaratti	Black	Irrigated	Bulb maturity	Local	37.14	SLB	Thrips
		Nesaragi	Black	Irrigated	Harvesting	Local	23.56	-	-
		Jakanayakanakoppa	Black	Irrigated	Harvesting	Local	26.78	-	-
		Govanakoppa	Black	Irrigated	Bulb maturity	Local	31.14	-	Thrips
		Tigadi	Red	Irrigated	Bulb maturity	Local	20.67	SLB	-
			Taluka mean				27.86		
			District mean				25.60		
Dharwad	Kundgol	Pashupatihala	Black	Irrigated	Bulb maturity	Local	35.14	-	Thrips
		Sanshi	Black	Irrigated	Bulb maturity	Local	26.87	-	Thrips
		Sultanapura	Black	Irrigated	Harvesting	Local	24.16	-	-
		Tarlaghatta	Black	Irrigated	Bulb maturity	Local	19.67	SLB	-
			Taluka mean				26.46		
			District mean				26.46		
Gadag	Lakshmeshwar	Ramageri	Black	Irrigated	Bulb maturity	Local	23.23	-	Thrips
		Govanala	Black	Irrigated	Bulb initiation	Local	17.67	-	-
		Madalli	Black	Rainfed	Harvesting	Local	19.63	-	-
			Taluka mean				20.18		
			District mean				20.18		
Haveri	Ranebennur	Antaravalli	Red	Irrigated	Bulb maturity	Local	31.11	-	Thrips
		Lingadahalli	Black	Irrigated	Harvesting	Local	45.21	-	Thrips
		Tirumaladevarakoppa	Black	Irrigated	Bulb maturity	Local	31.24	-	Thrips
		Yarekuppi	Black	Irrigated	Bulb initiation	Local	26.78	-	-
		Lakshmapura	Black	Irrigated	Bulb maturity	Local	19.62	-	-
		Hiremaganura	Red	Irrigated	Bulb maturity	Local	22.89	-	Thrips
			Taluka mean				29.48		
	Byadgi	Kadaramandalagi	Black	Irrigated	Bulb initiation	Local	18.67	-	-
		Chinnikatti	Black	Irrigated	Bulb maturity	Local	21.54	-	-
		Anura	Black	Irrigated	Harvesting	Local	23.44	-	Thrips
			Taluka mean				21.22		
	Rattihalli	Kudupali	Black	Irrigated	Bulb maturity	Local	29.17	-	-
		Badasangapura	Black	Irrigated	Bulb maturity	Local	18.41	-	-
		Kadura	Black	Irrigated	Bulb maturity	Local	11.54	-	-
		Masura	Black	Irrigated	Harvesting	Local	24.33	-	Thrips
			Taluka mean				20.86		
			District mean				23.85		
Vijayapura	Basavana	Ingaleshwara	Black	Irrigated	Bulb initiation	Local	19.69	-	-
	Bagewadi	Sankanala	Black	Irrigated	Bulb maturity	Local	32.48	-	Thrips
		Uppaladinni	Black	Irrigated	Bulb maturity	Local	16.05	-	-
		Savaladagi	Black	Irrigated	Bulb maturity	Local	28.55	-	Thrips
			Taluka mean				24.19		
	Muddebihal	Chondi	Black	Irrigated	Harvesting	Local	29.89	-	-
		Alakoppara	Black	Irrigated	Bulb maturity	Local	20.44	-	-
		Rudagi	Black	Irrigated	Harvesting	Local	26.67	-	Thrips
			Taluka mean				25.67		
			District mean				24.93		

SLB - Stemphylium leaf blight

maximum severity (26.67 PDI) was recorded in Belakeri village. The least severity (14.33 PDI) was recorded in Angaragatti. In Rattihalli taluka, the maximum severity of purple blotch (32.33 PDI) was recorded in Kirageri followed by Malagi village with severity of 29.21 PDI. The least severity (20.21 PDI) was recorded in Kudupali. Among the taluks surveyed in Haveri district, the maximum mean disease severity (35.25 PDI) was recorded in Ranebennur taluka and the least mean disease severity was recorded in Byadgi taluka (19.37 PDI).

In Vijayapura district, two taluks were surveyed, *viz*., Basavana Bagewadi and Muddebihal. In Basavana Bagewadi taluka, the highest severity of purple blotch (29.33 PDI) was recorded in Ingaleshwara followed by Byakoda village with severity of 26.14 PDI. The least severity (17.43 PDI) was recorded in Ivanagi village. Similarly in Muddebihal taluka, the maximum severity (34.21 PDI) was recorded in Amaragola village. The least severity (22.45 PDI) was recorded in Alakoppara. Among the taluks surveyed in Vijayapura district, the maximum mean disease severity (28.52 PDI) was recorded in Muddebihal followed by Basavana Bagewadi (23.69 PDI).

Severity of purple blotch during *Kharif* 2020

Totally 46 villages of 12 taluks and 6 districts were surveyed during *Kharif*, 2020. Maximum mean per cent disease severity was observed in Dharwad district (24.81 PDI) whereas, minimum mean per cent disease severity was noticed in Bagalkote district (16.43 PDI) (Table 3 and 5).

In Mudhol taluka of Bagalkote district, the highest severity of purple blotch (23.54 PDI) was recorded in Channala followed by Gulagala village with severity of 18.32 PDI. The least severity (10.72 PDI) was recorded in Lakkanatti village.

In Belagavi district, three taluks were surveyed *viz*., Savadatti, Ramdurg and Bailhongal. In Savadatti taluka, the higher severity of purple blotch (25.78 PDI) was recorded in Chikkumbi followed by Sutagatti village with severity of 24.56 per cent. The least severity (13.23 PDI) was recorded in Tadasalura village. Similarly in Ramdurg taluka, the maximum severity (23.67 PDI) was recorded in Chilamura followed by Budnikhurda with the severity of 23.33 PDI. The least severity (19.46 PDI) was recorded in Murakatnal village. In Baihongal taluka, the maximum severity (29.13 PDI) was recorded in Ujjanatti followed by Kalakuppi with the severity of 26.43 PDI. The least severity (21.28 PDI) was observed in Govanakoppa village. Among the taluks surveyed in Belagavi district, the maximum mean disease severity (24.74 PDI) was recorded in Bailhongal taluka followed by Ramdurg taluka (22.15 PDI).

In Kundgol taluka of Dharwad district, the maximum severity of purple blotch (28.62 PDI) was recorded in Ingalagi followed by Kalasa village with severity of 22.78 PDI. The least severity (13.61 PDI) was recorded in Nelagudda. Similarly in Dharwad taluka, the maximum severity (32.45 PDI) was recorded in Hangaraki village. The least severity (21.12 PDI) was recorded in Kabbenura. Among the taluks surveyed in Dharwad district, the maximum mean disease severity (27.95 PDI) was recorded in Dharwad taluka followed by Kundgol taluka (21.67 PDI).

In Gadag taluka of Gadag district, the maximum severity of purple blotch (24.67 PDI) was recorded in Chinchali and least severity (13.15 PDI) was recorded in Benakoppa. Similarly in Lakshmeshwar taluka, the maximum severity (22.36 PDI) was recorded in Madalli. The least severity (9.90 PDI) was recorded in Yalavatti. Among the taluks surveyed in Gadag district, the maximum mean disease severity (18.16 PDI) was recorded in Gadag taluka and the least mean disease severity was in Lakshmeshwar taluka (16.69 PDI).

In Ranebennur taluka of Haveri district, the maximum severity of purple blotch (32.68 PDI) was recorded in Lingadahalli followed by Halageri village with severity of 28.11PDI. The least severity (12.34 PDI) was recorded in Itagi. Similarly in Byadgi taluka, the maximum severity (26.45 PDI) was recorded in Alalageri village. The least severity (10.94 %) was recorded in Shivapura. Among the taluks surveyed in Haveri district, the maximum mean disease severity (22.36 PDI) was recorded in Ranebennur taluka and the least severity was recorded in Byadgi taluka (17.17 PDI).

In Vijayapura district, two taluks were surveyed *viz*., Basavana Bagewadi and Muddebihal. In Basavana Bagewadi taluka, the highest severity of purple blotch (28.45 PDI) was recorded in Ingaleshwara followed by Nagura village with severity of 25.14 per cent. The least severity (12.11 PDI) was recorded in Nagavada village. Similarly in Muddebihal taluka, the maximum severity (27.34 PDI) was recorded in Alakoppara village. The least severity (8.62 PDI) was recorded in Rudagi. Among the taluks surveyed in Vijayapura district, the maximum mean disease severity (21.84 PDI) was recorded in Basavana Bagewadi taluka followed by Muddebihal taluka (17.80 PDI).

Severity of purple blotch during *Rabi* 2020

Totally 46 villages of 12 taluks and 6districts were surveyed during *Rabi*, 2020. Maximum mean per cent disease severity was observed in Dharwad district (26.46 PDI) whereas, minimum mean per cent disease severity was noticed in Gadag district (20.18 PDI) (Table 4 and 6).

In Bagalkote district, two taluks were surveyed, *viz*., Bagalkote and Mudhol. In Bagalkote taluka, the highest severity of purple blotch (24.12 PDI) was recorded in Mugalolli. The least severity (18.32 PDI) was recorded in Ankalagi village. Similarly in Mudhol taluka, the highest severity of purple blotch (34.67 PDI) was recorded in Shirol followed by Kulali village with severity of 28.53 PDI. The least severity (19.76 PDI) was recorded in Dadanatti village. Among the taluks surveyed in Bagalkote district, the maximum mean disease severity (26.02 PDI) was recorded in Mudhol taluka followed by Bagalkote taluka (20.74 PDI).

In Belagavi district, three taluks were surveyed *viz*., Savadatti, Ramdurg and Bailhongal. In Savadatti taluka, the higher severity of

Table 5. Mean disease severity data of districts and taluks during *Kharif* 2019 and 2020

District	Taluka	Mean Per cent Disease Index (PDI)	
		2019	2020
Bagalkote	Mudhol	21.87	16.43
	Mean	21.87	16.43
Belagavi	Savadatti	20.44	20.69
	Ramdurg	16.36	22.15
	Bailhongal	20.76	24.74
	Mean	19.19	22.53
Dharwad	Kundgol	19.38	21.67
	Dharwad	26.18	27.95
	Mean	22.78	24.81
Gadag	Gadag	17.13	18.16
	Lakshmeshwar	12.78	16.69
	Mean	14.95	17.43
Haveri	Ranebennur	20.07	22.36
	Byadgi	14.76	17.17
	Mean	17.41	19.77
Vijayapura	Basavana Bagewadi	21.25	21.84
	Muddebihal	21.11	17.80
	Mean	21.18	19.82

Table 6. Mean disease severity data of districts and taluks during *Rabi* 2019 and 2020

District	Taluka	Mean Per cent Disease Index (PDI)	
		2019	2020
Bagalkote	Bagalkote	22.22	20.74
	Mudhol	26.45	26.02
	Mean	24.34	23.38
Belagavi	Savadatti	23.03	24.50
	Ramdurg	22.97	24.44
	Bailhongal	24.86	27.86
	Mean	23.62	25.60
Dharwad	Kundgol	27.80	26.21
	Mean	27.80	26.46
Gadag	Lakshmeshwar	17.40	20.18
	Mean	17.40	20.18
Haveri	Ranebennur	35.25	29.48
	Byadgi	19.37	21.22
	Rattihalli	26.06	20.86
	Mean	26.89	23.85
Vijayapura	Basavana Bagewadi	23.69	24.19
	Muddebihal	28.52	25.67
	Mean	26.11	24.93

purple blotch (31.14 PDI) was recorded in Inchala followed by Bhamagundikoppa village with severity of 28.12 PDI. The least severity (18.33 PDI) was recorded in Gontamara village. Similarly in Ramdurg taluka, the maximum severity (29.21 PDI) was recorded in Heerekoppa followed by Bhagojikoppa with the severity of 24.43 PDI. The least severity (19.67 PDI) was recorded in Chippalakatti village. In Baihongal taluka, the maximum severity (37.14 PDI) was recorded in Hanabaratti followed by Govanakoppa with the severity of 31.14 PDI. The least severity (20.67 PDI) was observed in Tigadi. Among the taluks surveyed in Belagavi district, the maximum mean disease severity (27.86 PDI) was recorded in Bailhongal taluka and the least mean disease severity was recorded in Ramdurg taluka (24.44 PDI).

In Kundgol taluka of Dharwad district, the maximum severity of purple blotch (35.14 PDI) was recorded in Pashupatihala followed by Sanshi village with severity of 26.87 PDI. The least disease severity (19.67 PDI) was recorded in Tarlaghatta.

In Lakshmeshwar taluka of Gadag district, the maximum severity of purple blotch (23.23 PDI) was recorded in Ramageri followed by Madalli village with severity of 19.63 PDI. The least disease severity (17.67 PDI) was recorded in Govanala.

In Ranebennur taluka of Haveri district, the maximum severity of purple blotch (45.21 PDI) was recorded in Lingadahalli followed by Tirumaladevarakoppa village with severity of 31.24 PDI. The least severity (19.62 PDI) was recorded in Lakshmapura. Similarly in Byadgi taluka, the maximum severity (23.44 PDI) was recorded in Anura village. The least severity (18.67 PDI) was recorded in Kadaramandalagi. In Rattihalli taluka, the maximum severity of purple blotch (29.17 PDI) was recorded in Kudupali followed by Masura village with severity of 24.33 PDI. The least severity (11.54 PDI) was recorded in Kadura. Among the taluks surveyed in Haveri district, the maximum mean disease severity (29.48 PDI) was recorded in Ranebennur taluka and the least mean disease severity was recorded in Rattihalli taluka (20.86 PDI).

In Vijayapura district, two taluks were surveyed *viz*., Basavana Bagewadi and Muddebihal. In Basavana Bagewadi taluka, the highest severity of purple blotch (32.48 PDI) was recorded in Sankanala followed by Savaladagi village with severity of 28.55 PDI. The least severity (16.05 PDI) was recorded in Uppaladinni village. Similarly in Muddebihal taluka, the maximum severity (29.89 PDI) was recorded in Chondi village. The least severity (20.44 PDI) was recorded in Alakoppara. Among the taluks surveyed in Vijayapura district, the maximum mean disease severity (25.67 PDI) was recorded in Muddebihal taluka followed by Basavana Bagewadi taluka (24.19 PDI).

During the survey other than the purple blotch, other diseases and insect pests were also observed. However, diseases like Cercospora leaf spot and Colletotrichum leaf blight; insect pests like cutworms and semiloopers were noticed during *Kharif* season while, *Stemphylium* leaf blight and thrips were noticed during *Rabi* season in some districts of northern Karnataka.

Severity of purple blotch of garlic as affected by seasons during 2019 and 2020

Data pertaining to the severity of purple blotch disease under *Kharif* and *Rabi* 2019 and 2020 are presented in the Table 7. Maximum mean per cent disease index (PDI) (24.80 and 24.28 PDI) was recorded in *Rabi* season as compared to *Kharif* season (19.34 and 20.64 PDI) during 2019 and 2020, respectively. In general, *Rabi* season recorded more disease when compared to *Kharif* season.

Severity of purple blotch of garlic as affected by soil type during *Kharif* 2019 and 2020

Data pertaining to the severity of purple blotch disease under red and black soil condition during *Kharif* 2019 and 2020 are presented in Table 8. Total 85 black soil and 8 red soil fields were visited. Mean per cent disease index (19.31 and 21.04 PDI) was recorded in black soils as compared to red soils (19.64 and 19.05) during *Kharif* 2019 and 2020, respectively.

Severity of purple blotch of garlic as affected by soil type during *Rabi* 2019 and 2020

Data pertaining to the severity of purple blotch disease under red and black soil condition during *Rabi* 2019 and 2020 are presented in Table 9. Total 85 black soil and 10 red soil fields were visited. Mean per cent disease index (25.58 and 25.06 PDI) was recorded in black soils as compared to red soils (24.66 and 22.68 PDI) during *Rabi* 2019 and 2020, respectively. Irrespective of seasons, black soils recorded more disease when compared to red soils.

Severity of purple blotch of garlic as affected by crop grown condition during *Kharif* 2019 and 2020

Table 7. Severity of purple blotch of garlic as affected by seasons during 2019 and 2020

Season/Year	Mean PDI	Disease Index
	2019	2020
Kharif	19.34	20.64
Rabi	24.80	24.28

Table 8. Severity of purple blotch of garlic as affected by soil type during *Kharif* 2019 and 2020

Year	Black soil		Red soil	
	No. of fields	Mean PDI	No. of fields	Mean PDI
2019	43	19.31	4	19.64
2020	42	21.04	4	19.05
Total	85		8	
Mean		20.18		19.35

During *Kharif* 2019 and 2020 survey (Table 10) total 67 rainfed and 26 irrigated fields were visited. Mean per cent disease index (21.74 and 23.30 PDI) was recorded in irrigated conditions as compared to rainfed conditions (18.61 and 19.69 PDI) during *Kharif* 2019 and 2020, respectively. Between two *Kharif* seasons, the purple blotch severity was more in 2020 as compared to 2019.

Severity of purple blotch of garlic as affected by crop grown condition during *Rabi* 2019 and 2020

During *Rabi*, 2019 and 2020 survey (Table 11) total 93 irrigated and 2 rainfed fields were visited. Mean per cent disease index (25.63 and 24.92 PDI) was recorded in irrigated conditions as compared to rainfed conditions (18.67 and 19.63 PDI) during *Rabi* 2019 and 2020, respectively. Between two *Rabi* seasons, the purple blotch severity was more in 2019 compared to 2020. Irrespective of seasons, irrigated fields recorded more disease when compared to rainfed fields.

Survey on the severity of disease helps to gather information on the prevalence, severity, distribution of disease and pathogen diversity in particular agro-climatic zone. Survey and surveillance form the basis for any successful plant protection that depends on early detection of disease followed by timely adoption of control measures. With this background the present study was taken up by conducting the roving survey in different districts of northern Karnataka *viz*., Bagalkote, Belagavi, Dharwad, Gadag, Haveri and Vijayapura, where the garlic was grown predominantly for commercial purpose.

Roving survey was conducted to collect the information regarding the severity of purple blotch disease, its distribution in different agro climatic eco-system and also to find out the prevalence and diversity of the pathogen in different garlic growing districts of Northern Karnataka during *Kharif* and *Rabi* 2019 and 2020. The severity of disease was expressed as per cent disease index. This information is necessarily needed to find out the extent of damage caused by the pathogen thereby, to come out with best management strategies to overcome the disease in future. The survey also supplements the information on type of soil and irrigated/rainfed situation in which crop grown, susceptible stage of the crop, other diseases and insect pests prevailed on that particular locality.

The survey results revealed that purple blotch was more during the year 2020 than 2019 and the disease varied from location to location, season to season and year to year. Such variation is attributed to various environmental factors like temperature, relative humidity, pattern of rainfall and even it could also be attributed to existence of variability in pathogen and cropping pattern (Kodate, 2020).

Among the different districts surveyed for purple blotch during *Kharif* and *Rabi* 2019 and 2020, Dharwad recorded the highest severity of 22.78 and 24.81 per cent during *Kharif* 2019 and 2020; 27.80 and 26.46 per cent during *Rabi* 2019 and 2020, respectively. The least severity was recorded in Gadag district (14.95 PDI and 17.43 PDI during *Kharif* 2019 and 2020; 17.40PDI and 20.18 PDI during *Rabi* 2019 and 2020, respectively). Similar results were observed by Srivastava *et al*. (1994) in their research on status of field diseases and insect pest of onion in India who observed that purple blotch incidence was high in both rainy and post-rainy seasons when high humidity prevailed. The results are also in conformity with findings of Chethana (2000), whoalso noticed the highest per cent disease incidence in Ronihal village (Basavana Bagewadi taluka) of Bijapur district and lowest in Wadullur village of Raichur taluka. Similar findings were also reported by Shrikanth (2000) who carried out a survey on leaf blight of garlic during *Kharif* and *Rabi* 1998-99 in parts of Karnataka and noticed the highest disease severity (83.27 and 77.15 PDI) in Dharwad taluka during *Kharif* and *Rabi,* respectively. Pradnyarani andKulkarni (2014) reported the highest per cent disease index of purple blotch in fields of Sangreshkoppa village (46.00 PDI) in Belgaum district and the least per cent disease index recorded in Hulkund village (3.00 PDI) in Belgaum district and Priya*et al*. (2016) reported highest per cent disease index of purple blotch was noticed in Ilkal village of Bagalkote and least was noticed in Kerur village of Bagalkote district.

Such variations in the disease severity was also observed by Kodate (2020) who reported that highest severity of purple blotch of onion in Dharwad district (43.74 PDI) followed by Belagavi district (37.17 PDI) and the least severity in Gadag district (33.19 PDI) which clearly indicated that the disease development and severity depends on factors like stage of the crop, cultural practices adopted and type cultivars grown. Apart from these, it also depends on congenial climatic conditions prevailing in that area for the disease development. Similar observations were also made by Ravichandran *et al*. (2017) and Shilpa *et al*. (2017) who opined that purple blotch prevailed in all districts of northern Karnataka wherever onion is grown extensively.

Maximum mean per cent disease index (24.80 and 24.28 PDI) was recorded in *Rabi* season as compared to *Kharif* season (19.34 and 20.64 PDI) during 2019 and 2020, respectively. Fields with black soil recorded more disease severity (20.18 and 25.32 PDI) when compared to red soils (19.35 and 23.67 PDI) during *Kharif* and *Rabi* 2019 and 2020, respectively. Irrespective of the seasons and years, disease severity was more severe in irrigated condition compared to rainfed condition. This may be attributed due to protective irrigations helping in the pathogen multiplication because of high relative humidity and development of micro climate, weed menace has increased which harboured thrips and their population has played an important role in pathogen penentration into the host and development of disease. The results are in fine tune with investigations conducted by Tiwari

Table 9. Severity of purple blotch of garlic as affected by soil type during *Rabi* 2019 and 2020

Year	Black soil		Red soil	
	No. of fields	Mean PDI	No. of fields	Mean PDI
2019	44	25.58	5	24.66
2020	41	25.06	5	22.68
Total	85		10	
Mean		25.32		23.67

Table 10. Severity of purple blotch of garlic as affected by crop grown condition during *Kharif* 2019 and 2020

Year	Irrigated		Rainfed	
	No. of fields	Mean PDI	No. of fields	Mean PDI
2019	11	21.74	36	18.61
2020	15	23.30	31	19.69
Total	26		67	
Mean		22.52		19.15

Table 11. Severity of purple blotch of garlic as affected by crop grown condition during *Rabi* 2019 and 2020

Year	Irrigated		Rainfed	
	No. of fields	Mean PDI	No. of fields	Mean PDI
2019	48	25.63	1	18.67
2020	45	24.92	1	19.63
Total	93		2	
Mean		25.28		19.15

et al. (2020) who recorded more disease severity in the thrips incidence fields during *Rabi* season compared to *Kharif* season and confirmed that disease severity increases with increase in thrips population.

Prevalence of higher disease intensity in Dharwad district may be due to congenial climatic conditions like relative humidity, cool temperature, existence of initial inoculum in that particular location and cultivation of same local cultivars in larger scale. These conditions might have influenced inoculum multiplication, perpetuation and hastened the infection process of the fungus *A. porri.* Purple blotch can be a persistent and devastating disease since a severe epidemic will decrease photosynthesis, increase respiration and transpiration, impair vegetative and bulb growth and ultimately reduce yield and quality.

Conclusion

The survey conducted in six districts of northern Karnataka revealed that purple blotch was prevalent in all the garlic growing areas of the state and disease severity varied from 7.87 to 45.21 PDI. In Dharwad district, the highest mean per cent disease severity was observed (22.78 and 24.81 PDI during *Kharif* 2019 and 2020; 27.80 and 26.46 PDI during *Rabi* 2019 and 2020, respectively) whereas, minimum mean per cent disease severity was noticed in Gadag district (14.95 and 17.43 PDI during *Kharif* 2019 and 2020; 17.40 and 20.18 PDI during *Rabi* 2019 and 2020, respectively). However, the higher severity of disease was noticed in *Rabi* (24.80 and 24.28 PDI) compared to *Kharif* (19.34 and 20.64 PDI) during 2019 and 2020, respectively. In general, black soils (20.18 and 25.32 PDI) recorded more disease when compared to red soils (19.35 and 23.67 PDI) during *Kharif* and *Rabi* 2019 and 2020, respectively. Irrespective of the seasons and years, disease severity was more severe in irrigated condition compared to rainfed condition.The current study provides the data on the severity and distribution of purple blotch in major garlic growing areas of Northern Karnataka and to find out the hot spots of *Alternaria porri* in different districts of Northern Karnataka.

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