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SURVEY FOR THE SEVERITY OF CHILLI ANTHRACNOSE IN DIFFERENT CHILLI GROWING DISTRICTS OF KARNATAKA, INDIA

Vandana[1]*, N. Thammaiah[2], M.P. Basavarajappa[1], Noorulla Haveri[1], I.B. Biradar[3], H. Ramanagouda[4], Raveendra S. Jawadagi[5] and Prabhudeva S. Ajjappalavara[6]

[1]Department of Plant Pathology, College of Horticulture, Bagalkot - 587 104, Karnataka, India.
[2]Department of Plant Pathology, College of Horticulture, Munirabad, Koppal - 583 233, Karnataka, India.
[3]Department of Natural Resource Management, College of Horticulture, Bagalkot - 587 104, Karnataka, India.
[4]Department of Entomology, College of Horticulture, Bagalkot - 587 104, Karnataka, India.
[5]Department of Vegetable Sciences, College of Horticulture, Bagalkot - 587 104, Karnataka, India.
[6]Department of Vegetable Science, College of Horticulture Sirsi, Karnataka, India.
*Corresponding author E-mail : mantaplabp@gmail.com
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ABSTRACT

Chilli (*Capsicum* spp.), belonging to the family solanaceae, is one of the most economically and culturally important spice crops worldwide. Naturally, the chilli production were affected by both biotic, *viz.*, fungi, bacteria, nematodes and viruses, insect pests (aphids, thrips, mites, midges and fruit borer) and weeds and abiotic factors, *viz.*, temperature, moisture, light and chemicals. Among these, anthracnose is particularly economically significant, as it contributes to pre and post harvest fruit decay which is infected by several species of *Colletotrichum* spp. Thus, conducting survey in major chilli growing belts helps in knowing disease intensity, suitable management measures and collection of isolates. Roving survey was conducted during *kharif* 2022 in Bagalkot, Belagavi, Dharwad, Gadag and Haveri districts of northern Karnataka. Mean highest per cent disease index (PDI) was recorded in Dharwad district for leaf spot (60.00), green fruit rot (48.23) and red fruit rot (55.76) and highest mean disease incidence of 36.72% for dieback (36.72%) was recorded from Dharwad district. Lowest PDI of 20.32 for leaf spot, 3.33 for green fruit rot, 0.00 for red fruit rot, and mean disease incidence of 0.00 for dieback in Chitradurga district during both *kharif* seasons. Among the taluks surveyed, Annigeri taluk of Dharwad district recorded highest PDI for leaf spot (69.00), green fruit rot (60.95), red fruit rot (63.35) and die back disease incidence of 54.74%. Lowest PDI of 18.70 was recorded in Manvi taluk of Raichur district. Fruit rot on green chillies was not recorded in the fields of Hosadurga, Holalkere and Sindgi taluk. Similarly, symptoms of red fruit rot were not recorded in the fields of Ramadurga, Gokak, Hiriyur, Hosadurga, Holalkere, Vijayapura and Sindgi. Also, there were no symptoms of die back in the fields of Hiriyur, Hosadurga, Holalkere and Manvi. Morphological examination of samples from the surveyed region revealed that *Colletotrichum capsici*, *C. gloeosporioides* and *C. acutatum* were the major species infecting chilli.

Key words : Chilli, *Colletotrichum* spp., Disease incidence, Percent disease index, Chilli anthracnose, Survey.

Introduction

Chilli (*Capsicum* spp.), belonging to the family solanaceae, is one of the most economically and culturally important spice crops worldwide. With its unique pungency and flavor profile, chilli is a staple in culinary practices across diverse cultures. India, China, Thailand and Mexico are among the leading producers, catering to both domestic demand and international markets (http://www.fao.org/faostat). Producing 1.98 million tonnes annually, India contributes 43% of global chilli production, followed by major producers such as China, Ethiopia, Thailand, Pakistan, and Bangladesh (Kiruthika *et al.*, 2024). The Third Advance Estimates for 2023-2024 provide valuable data on green chilli cultivation across various Indian states. Nationally, green chillies are

cultivated over 423.72 thousand hectares, yielding a total production of 4588.69 thousand metric tons (MT) at an average productivity of 10.83 MT per hectare. Among the leading states, Madhya Pradesh ranks first with a production of 1,017.87 thousand MT from 64.12 thousand hectares, achieving a high yield of 15.88 MT per hectare. Karnataka also ranks as a significant contributor, with a production of 646.16 thousand MT over 47.26 thousand hectares and a productivity of 13.67 MT per hectare (Anonymous, 2024).

Naturally, the chilli production were affected by both biotic, *viz.* (fungi, bacteria, nematodes and viruses), insect pests (aphids , thrips, mites, midges and fruit borer), weeds and abiotic factors, *viz.*, temperature, moisture, light and chemicals. Among these, anthracnose is particularly economically significant, as it contributes to pre and post harvest fruit decay (Poonpolgul and Kumphai, 2007) which is infected by several species of *Colletotrichum* spp. during green mature stage and fully ripened red stage of chilli, extending even after the harvest. This disease was first time reported in India by Sydow during 1913 from Coimbatore (Ridzuan *et al*., 2018). Usually anthracnose of chilli has been shown to be caused by *C. capsici, C. gloeosporioides* and *C. acutatum.* However, several other species of *Colletotrichum viz., C. scovillei, C. coccodes, C. brisbanense, C. nymphaeae, C. dematium, C. kartsii, C. siamense* and *C. asianum* were also reported to cause chilli anthracnose in different chilli growing regions of the world (Banya *et al*., 2020). The disease has led to significant yield losses worldwide, with reports of up to 10–60% in India. Typical symptoms of anthracnose on chilli fruit includes dark, sunken necrotic spots, water soaked lesions with concentric rings of acervuli. Building on this context, the objectives for the present investigation were: 1. To study the severity of anthracnose disease of chilli through survey.

Materials and Methods

A roving survey for occurrence of chilli anthracnose was undertaken in farmer's field in different places of chilli growing areas of Bagalkote, Belagavi, Chitradurga, Dharwad, Gadag, Raichur and Vijayapura, during *kharif* (2022) season. The observations on disease incidence for die back and percent disease index (0-9 scale) for leaf spot, fruit rot were recorded in each plot (Fig. 1). In each field surveyed, hundred plants/ field or twenty five fruits/ plant were observed to calculate disease incidence using the following formula (McKinney, 1923).

$$\text{Disease incidence (DI)} = \frac{\text{Number of samples infected}}{\text{Total no. of samples examined}} \times 100$$

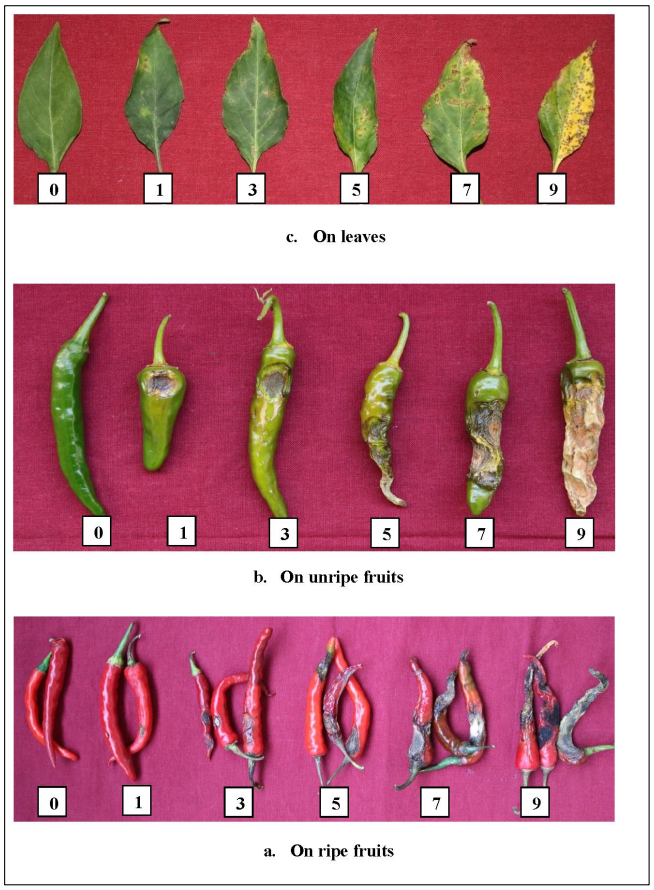

Fig. 1 : Disease rating scale (0-9 score) for chilli athracnose.

Percent disease index was calculated by using below given formula (Wheeler, 1969) following 0-9 scale given by Mayee and Datur (1986).

$$\text{Percent disease index (PDI)} = \frac{\text{Sum of numerical disease rating}}{\text{Total number of samples} \times \text{maximum of disease rating scale}} \times 100$$

Grade	Percent fruit/ leaf area infection/branches infected per plant
0	No infection
1	1-10
3	11-25
5	26-50
7	51-75
9	>75

Results and Discussion

The survey results revealed that the disease intensity varied from locality to locality because of environmental conditions and also cropping patterns. The disease intensity was not consistent in all the localities under the study. The survey results (Table 1 and Fig. 2) indicated that among the seven districts surveyed, Dharwad exhibited the highest mean percent disease index leaf

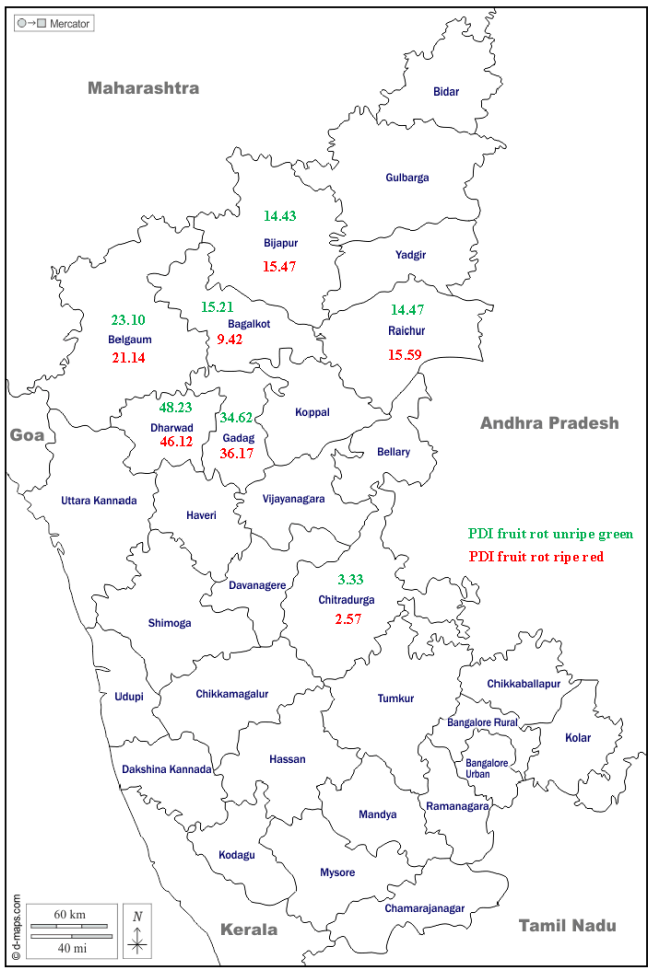

Fig. 2 : Map showing per cent disease index of fruit rot (anthracnose) in surveyed districts during *kharif* 2022 in Karnataka.

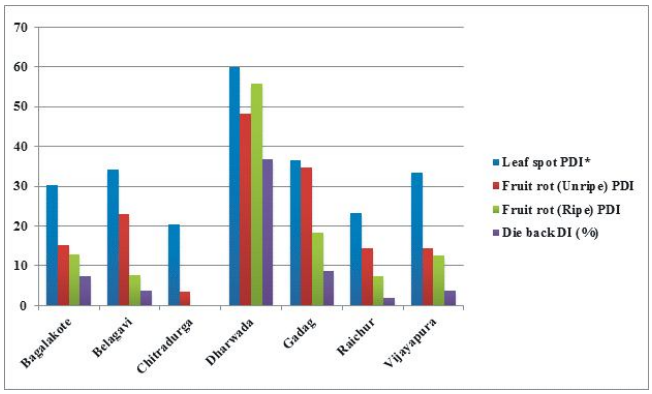

Fig. 3 : Intensity and incidence of anthracnose in major chilli growing districts of Karnataka during *kharif* 2022.

spot (60.00), green fruit rot (48.23) and red fruit rot (55.76) and mean disease incidence for dieback (36.72%). Gadag followed with mean disease index of 36.54 for leaf spot, 34.62 for green fruit rot, 18.30 for red fruit rot, and mean disease incidence of 8.68 for dieback. In contrast, Chitradurga recorded the lowest mean percent disease index for leaf spot (20.32) and green fruit rot (3.33). Notably, no symptoms of red fruit rot or dieback were observed in Chitradurga (Fig. 3).

Among the different taluks of the districts surveyed (Table 1), Annigere recorded highest mean per cent disease index for leaf spot (69.00), green fruit rot (60.95) and red fruit rot (63.35). At the same time highest disease incidences of 54.74% was recorded for die back. This was followed by Dharwad taluk of Dharwad district with mean per cent disease index for leaf spot (63.76), green fruit rot (48.23), red fruit rot (61.17) and mean disease incidence for die back with 40.00%. The least mean per cent disease index for leaf spot (18.70), green fruit rot (12.89), red fruit rot (8.11) and no die back symptoms were recorded from Manvi taluk of Raichur district. Holalkere of Chitradurga followed this with Mean per cent disease index of 19.67% and no symptoms of fruit rot and die back were recorded from this taluk.

Total of sixty fields were surveyed and all showed leaf spot disease. Out of sixty fields, twelve fields showed no disease incidence on green fruits and twenty three fields did not show any red fruit rot disease as the crops in these fields were either fruiting or flowering stage during survey. Fifteen fields among the sixty surveyed fields were free from die back disease (Table 1). The mean of per cent disease index of all the districts surveyed were highest for leaf spot disease (33.99) followed by green unripe fruit rot (21.91).

The increase in disease severity during *kharif* 2022 in Annigeri was mainly due to increase in rainfall (1037 mm) during the fruiting period which favored the pathogen dispersal and disease development. Kundgol recorded lower rainfall of 980 mm (Anonymous, 2022). In addition to this, all the crops of surveyed the surveyed fields were Byadagi Dabbi and were in ripening stage which is reported to be the most susceptible stage of the crop (Sharath, 2020).

Similar results were reported from Harshitha *et al.* (2022) during *kharif* 2020 and *kharif* 2021 survey in major four chilli growing districts *viz.*, Belagavi, Dharwad, Gadag and Haveri in which the highest PDI of 50.35 reported in Dharwad district. These results are in accordance with Rajput (2010), who reported that the highest severity of anthracnose was noticed in Nalvadi (46.35) of Dharwad district followed by Saunshi (42.85) of Kundgol taluk. Among the three surveyed districts Dharwad showed highest PDI of 48.02 followed by Gadag district (36.75) which was stated mainly due to the medium black soil type that has maximum moisture holding capacity, rain fed fields and ripening stage of the crop that is most susceptible. So, the results of the present

Table 1 : Intensity and incidence of anthracnose in major chilli growing districts of Karnataka during *kharif* 2022.

District	Taluk	Village	Variety	Crop stage		PDI		Die back
					Leaf spot	Fruit rot (Unripe)	Fruit rot (Ripe)	DI (%)
Bagalkote	Badami	Sulikeri	Byadagi Dabbi	Fruiting	30.14	30.50	1.20	5.74
		Konkana koppa	Local	Flowering	35.41	0.00	1.80	10.47
		Halakurki	Local	Ripening	58.33	56.50	31.50	11.47
		Hiremuchalagudda	Byadagi Dabbi	Ripening	35.50	33.33	1.56	2.45
		Hulageri	Byadagi Dabbi	Flowering	30.44	0.00	0.00	5.47
		Chirlakoppa	Local	Ripening	36.44	22.00	18.26	6.47
	Taluk mean				**37.71**	**32.99**	**23.72**	**7.01**
	Bagalkote	Manahalli	Local	Fruiting	20.11	34.10	1.50	5.47
		Bilkerur	Byadagi Dabbi	Fruiting	46.12	0.00	1.11	3.18
		Sigikeri	Byadagi Dabbi	Fruiting	25.11	0.00	0.00	3.85
		Bevinamatti	Private	Fruiting	12.50	0.00	1.93	1.18
		Bhagavati	Byadagi Dabbi	Ripening	32.63	28.67	25.46	2.08
	Taluk mean				**27.23**	**16.34**	**5.00**	**15.76**
	Bilagi	Badagandi	Byadagi Kaddi	Ripening	28.18	15.33	20.15	2.14
		Sunaga	Byadagi Dabbi	Fruiting	35.00	0.00	0.00	4.12
	Taluk mean				**31.59**	**7.64**	**10.08**	**3.13**
	Mudhol	Chawadapur	Local	Fruiting	28.23	0.00	21.53	5.74
		Kanasageri	Byadagi Kaddi	Ripening	24.15	11.61	15.76	3.12
		Kasaba jambagi	Byadagi Dabbi	Fruiting	21.00	0.00	0.00	0.00
	Taluk mean				**24.46**	**3.87**	**12.43**	**2.95**
District mean					**30.73**	**15.21**	**12.81**	**7.25**
Belagavi	Ramdurga	Kesara goppa	Private	Fruiting	24.41	22.14	0.00	0.00
		Guttigoli	Local	Fruiting	26.70	17.64	0.00	3.12
	Taluk mean				**25.56**	**19.89**	**0.00**	**1.56**
	Gokak	Kallolli	Byadagi Dabbi	Fruiting	**43.47**	**26.66**	**0.00**	**7.45**
	Bailhongal	Basapur	Local	Ripening	**33.68**	**22.75**	**23.18**	**2.14**
Chitradurga	Hiriyur	Iddalanagenahalli	Local	Flowering	16.48	0.00	0.00	0.00
		Hiriyur	Local	Fruiting	24.88	20.00	0.00	0.00
	Taluk mean				**20.68**	**10.00**	**0.00**	**0.00**
	Hosadurga	Aralihalli	Local	Flowering	**20.62**	**0.00**	**0.00**	**0.00**
	Holalkere	Holalkere	Local	Flowering	**19.67**	**0.00**	**0.00**	**0.00**
District mean					**20.32**	**3.33**	**0.00**	**0.00**
Dharwad	Annigeri	Annigeri	Byadagi Dabbi	Ripening	**69.00**	**60.95**	**63.35**	**54.74**
	Dharwad	Karadi gudda	Byadagi Dabbi	Ripening	**63.76**	**48.23**	**61.17**	**40.00**
	Kundgol	Kundgol	Byadagi Dabbi	Ripening	53.32	38.67	51.22	26.45

Table 1 continued...

Table 1 continued...

		Yaraguppi	Byadagi Dabbi	Ripening	38.55	29.50	38.18	11.51
		Benakana halli	Byadagi Dabbi	Ripening	45.55	34.44	42.22	12.41
		Hosakatti	Byadagi Dabbi	Ripening	51.58	39.44	39.45	23.1
	Taluk mean				**47.25**	**35.51**	**42.77**	**15.41**
District mean					**60.00**	**48.23**	**55.76**	**36.72**
Gadaga	Gadaga	Niralagi	Byadagi Dabbi	Fruiting	35.50	38.68	0.00	10.45
		Benakana koppa	Byadagi Dabbi	Ripening	42.33	41.28	44.62	11.45
	Taluk mean				**38.92**	**39.98**	**22.31**	**10.95**
	Ron	Abbigeri	Local	Fruiting	25.68	25.17	0.00	5.00
		Ron	Local	Fruiting	32.50	25.46	1.55	8.84
		Kotbal	Byadagi Dabbi	Ripening	42.45	39.24	30.00	10.53
		Hirealagundi	Byadagi Dabbi	Ripening	36.00	27.16	25.59	5.24
	Taluk mean				**34.16**	**29.26**	**14.29**	**6.40**
District mean					**36.54**	**34.62**	**18.30**	**8.68**
Raichur	Devadurga	Devadurga	Byadagi Kaddi	Fruiting	20.32	8.56	0.00	0.00
		Gabbur	Byadagi Kaddi	Fruiting	25.55	8.00	2.51	3.48
		Honnutagi	Byadagi Kaddi	Ripening	30.08	19.25	10.17	2.54
	Taluk mean				**25.32**	**11.94**	**4.23**	**2.01**
	Manvi	Kallur	Byadagi Kaddi	Fruiting	12.32	7.50	0.00	0.00
		Nandihal	Byadagi Kaddi	Ripening	25.08	18.28	16.22	0.00
	Taluk mean				**18.70**	**12.89**	**8.11**	**0.00**
	Raichur	Anwar	Local	Fruiting	25.64	18.11	0.00	3.33
		Khanapur	Byadagi Kaddi	Ripening	26.82	18.75	28.68	4.75
		Raichur	Local	Fruiting	25.45	18.89	0.00	3.33
					25.97	**18.58**	**9.56**	**3.80**
District mean					**23.33**	**14.47**	**7.30**	**1.94**
Vijayapura	Vijayapura	Hittanahalli	Byadagi Dabbi	Fruiting	28.50	10.11	0.00	5.14
		Hittanahalli	Byadagi Dabbi	Fruiting	30.00	15.50	0.00	0.00
			Byadagi Dabbi	Fruiting	34.66	20.22	0.00	2.84
	Taluk mean				**31.05**	**15.28**	**0.00**	**2.66**
	Basavana Bagewadi	Savanahalli	Byadagi Dabbi	Ripening	22.66	6.74	1.11	0.00
		Jeeralabhavi	Guntur	Fruiting	10.18	5.82	0.00	0.00
		Muddapura	Byadagi Dabbi	Fruiting	28.45	10.00	0.00	0.00
		Jayawadgi	Byadagi Dabbi	Ripening	51.50	25.76	27.98	8.52
		Yarnal	Byadagi Dabbi	Ripening	23.15	19.52	14.11	0.00
		Nandihal	Byadagi Dabbi	Ripening	22.14	15.75	19.74	0.00
	Taluk mean				**26.35**	**13.93**	**9.70**	**1.42**
	Sindgi	Hunshyal	Guntur	Flowering	**48.22**	**0.00**	**0.00**	**1.11**
	Kolhar	Mulawad	Byadagi Dabbi	Ripening	**33.25**	**24.66**	**31.88**	**9.51**
	Muddebihal	Bhantnur	Local	Ripening	**27.45**	**18.28**	**25.99**	**3.45**
District mean					**12.51**	**3.63**	**33.26**	**14.43**

investigation is in accordance with these reports where the PDI was recorded maximum in the fields where crops are at ripening stage that were grown under rain fed condition with medium black soil and all the fields surveyed were grown with Byadagi Dabbi seeds which are the susceptible variety of chili for anthracnose disease.

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