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Survey on occurrence of alternaria leaf blight in turmeric in Karnataka

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Abstract
Turmeric (*Curcuma longa* L.) is known as 'Indian saffron' is an important commercial spice crop grown in India. The area is increasing year by year due to its culinary, medicinal and traditional usage. Although turmeric is considered to be a medicinal plant, it is susceptible to various diseases. Among the various diseases, leaf blight caused by *Alternaria alternata* (Fr.) Keissler, is one of the most serious foliar disease in all the turmeric growing regions of the world. In Karnataka majority of the commercially grown varieties are susceptible to *A. alternata*. The survey work was carried out to study the occurrence and spread of the disease in major turmeric growing areas of Karnataka. An intensive roving survey was carried out to assess the incidence of leaf blight of turmeric. The survey was conducted during 2018 and 2019 in areas Bidar, Kalaburagi, Yadgir, Raichur, Koppala, Bagalkot, Mysuru, Kodagu, Chamarajanagar, Shivamogga, Belagavi and Uttar Kannada districts of Karnataka to assess the severity of leaf blight of turmeric in the farmer's field, when the crop is five months old the roving survey was conducted in 51 villages of 30 taluks covering 12 districts of Karnataka. Among the villages surveyed, the maximum disease intensity was observed in Ilawala village of Mysuru taluk (38.80 PDI). Maximum mean disease intensity at taluk level was recorded in Mysuru taluk (38.80 PDI), whereas minimum disease intensity was recorded in Hukeri taluk (1.50 PDI) of Belagavi district. At district level, maximum mean disease intensity was recorded in Mysuru district with 39.50 PDI while minimum intensity was observed in Yadgiri district with 3.20 PDI.

Keywords: Alternaria leaf blight, Disease intensity, PDI, Survey

Introduction
Turmeric (*Curcuma longa* L.) is an ancient and sacred spice of India. It is known as 'Indian saffron' due to its characteristic flavour and it is used as an expensive substitute of saffron. Turmeric is an important commercial spice crop grown in India. The Hindus, both tribal and civilized consider turmeric as a sacred and auspicious. It is associated with several rituals from ancient period and the tradition still in going on. In some tribal communities in Tamil Nadu, Andhra Pradesh and in the North-East regions of India, a piece of turmeric tied to a thread, dyed yellow with turmeric powder is weared as a nuptial string. Turmeric is also used as an amulet and a piece of turmeric tied on the hand with black sting is believed to keep away some evil spirits. The area is increasing year by year as culinary, medicinal and traditional usage (Anonymous, 2022) [1].

Although turmeric is considered to be a medicinal plant, it is susceptible to various diseases, insect pests and physiological disorders. Fungi are the major group of pathogens responsible for foliar and rhizome rot diseases. The important diseases affecting the crop are leaf blight, leaf spot, leaf blotch, leaf blast and rhizome rot (Ravindran, 2007) [4]. Among the various diseases, leaf blight caused by *Alternaria alternata* (Fr.) Keissler, is one of the most serious foliar disease in all the turmeric growing regions of the world and in Karnataka majority of the commercially grown varieties are susceptible to *A. alternata*. In India, the incidence of *Alternaria* sp. on the host plant was reported by Singh and Chowdhary (2008) [6]. The incidence of the pathogen was also reported from Tenali (Andra Pradesh) by Rangaswami *et al*. (1970) [5]. Mallikarjun (1996) [3] reported that, turmeric leaf blight caused by *A. alternata* was a serious disease and caused considerable damage to turmeric plant in almost all turmeric growing areas of Northern Karnataka.

The survey work was carried out to study the occurrence and spread of the disease in major turmeric growing areas of Karnataka.

Material and methods

An intensive roving survey was carried out to assess the incidence of leaf blight of turmeric. The survey was conducted during 2018 and 2019 in areas Bidar, Kalaburagi, Yadgir, Raichur, Koppala, Bagalkot, Mysuru, Kodagu, Chamarajanagar, Shivamogga, Belagavi and Uttar Kannada districts of Karnataka to assess the severity of leaf blight of turmeric in the farmer's field, when the crop is five months old. In each district, three major turmeric growing taluks were selected and in each taluk two villages covering three fields were surveyed and the per cent disease index was calculated by using formula as furnished and expressed as PDI (Wheeler, 1969) [7].

$$\text{Per cent disease indix (PDI)} = \frac{\text{Sum of numerical ratings}}{\text{No. of plants observed} \times \text{Maximum grade}} \times 100$$

Table 1: Disease scoring scale for leaf blight disease of turmeric

Grade	Per cent infection
0	No disease
1	1-5% leaf area covered
2	6-10% leaf area covered
3	11-25% leaf area covered
4	26-50% leaf area covered
5	> 50% leaf area covered

Intensity of Alternaria leaf blight disease during 2018

A total of in 51 villages affiliated to 30 taluks covering 12 districts of Karnataka were surveyed during 2018. Among the villages surveyed, the maximum disease intensity was observed in Ilawla village of Mysuru taluk (55.20 PDI) and no incidence of the disease was recorded in Shippur village of Hukkeri taluk. Maximum mean disease intensity at taluk level was recorded in Mysuru taluk (55.20 PDI), whereas minimum disease intensity was recorded in Balaganuru (1.5%) of Sindanur taluk but no disease was observed at Hukeri taluk of Belagavi district. At district level, maximum mean disease intensity was recorded in Mysuru district with 39.50 PDI while minimum intensity was observed in Bidar district with 10.76 PDI.

A roving survey conducted in Bidar district revealed a mean disease intensity of 10.76 PDI. In two taluks surveyed, Humnabad and Basavakalyana recorded mean taluk level disease intensity of 7.00 and 7.10 PDI, respectively. Among the villages maximum disease intensity was recorded in Nirna village (11.70 PDI) of Humnabad taluk followed by Boshaga village (7.20 PDI) of Basavakalyana taluk.

Mean disease intensity in Kalaburagi district was recorded as 17.88 PDI during the survey. Among the four taluks surveyed, *viz*., Aland, Chincholi, Jewargi and Kalaburagi, Chincholi taluka recorded the maximum disease intensity (24.59 PDI) followed by Aland taluk (10.85 PDI). Among the villages, Kodampur village of Chincholi taluk recorded maximum disease intensity of 35.60 PDI followed by Tajilapur village of Chincholi taluk with 30.65 PDI. In Alanda taluk, maximum disease intensity was observed in Mogha village at 28.30 PDI, followed by Jawalaga village (10.20 PDI). However, Kalaburagi and Jewargi taluk recorded the mean disease intensity of 6.20 and 5.80 PDI, respectively.

Three fields were surveyed in Doranahalli village of Shahapur taluk affiliated to Yadgir district with taluk average disease intensity of 5.25 PDI.

In Raichur district, the mean disease intensity was recorded at 15.00 PDI. In two taluks surveyed viz., Sindhanur and Lingasugur. Lingasugur taluk recorded maximum disease intensity of 18.60 PDI followed by Sindhanur taluk (8.54 PDI). Among the villages surveyed, Machanur village of Lingsugur taluk recorded maximum disease intensity of 18.60 PDI followed by Badlapur village of Sindhanur taluk (15.60 PDI).

In Koppal district, the mean disease intensity was recorded at 7.10 PDI. Three taluks such as Karatagi, Kustagi and Yelaburga were surveyed and mean disease intensity of 12.60, 5.80 and 4.30 PDI was observed, respectively. Among the villages surveyed, Juratagi village of Karatagi taluk observed maximum disease intensity of 12.60 PDI followed by Dothihal village of Kustagi taluk (5.80 PDI) and Bewoor village of Yelaburga taluk (4.30 PDI).

The mean disease intensity in Bagalkot district was recorded as 6.75 PDI. In three taluks surveyed, Bagalkot taluka recorded the maximum disease intensity of 8.66 PDI followed by Mudhool taluk (8.25 PDI) and Jamkhandi taluk (3.45 PDI). Among the villages, Mallapura village of Mudhool taluk recorded maximum disease intensity of 12.30 PDI. In Bagalkot taluk, maximum intensity was recorded in Bewoor village (10.20 PDI) followed by Domanal village (8.60 PDI). In Jamkhandi taluk, Hippargi and Kurgodu village were observed with disease intensity of 4.60 and 2.30 PDI, respectively.

In Mysuru district revealed the mean disease intensity of 47.13 PDI. Mysuru taluk recorded maximum mean disease intensity of 55.20 PDI followed by Piriyapatna (47.60 PDI) and Hunasuru (38.60 PDI). Among the villages surveyed, Ilawala village of Mysuru taluk recorded maximum disease intensity of 55.20 PDI followed by Piriyapatna Kasaba and Hunsur Kasaba with 47.60 and 38.60 PDI, respectively.

In Kodagu district, maximum mean disease intensity was observed as 15.76 PDI. Among the three taluks, Madikeri taluk observed with maximum disease intensity of 22.50 PDI, followed by Somvarpete and Virajpete taluk with 16.20 and 8.60 PDI. Among the villages surveyed, Kalooru village of Madikeri taluk recorded maximum disease intensity of 22.50 per cent followed by Neergunda village of Somvarpete taluk with 16.20 PDI.

The mean disease intensity in Chamarajanagar district was recorded at 19.17 PDI. Across the two taluks, Chamarajnagar taluk recorded maximum mean disease intensity of 21.15 PDI followed by Gundlupete taluk at 15.20 PDI. In Chamarajnagar taluk, Chickbegur village observed maximum disease intensity of 27.80 PDI followed by Banahalli village at 14.50 PDI. However, Hanchipura village of Gundlupet taluk recorded disease intensity of 15.20 PDI.

A roving survey conducted in Shivamogga district revealed the mean disease intensity of 13.13 PDI. In three taluks surveyed, *viz*., Shivamooga, Sagara and Tirthahalli. Shivamooga taluk recorded maximum disease intensity of 16.70 PDI followed by Tirthahalli taluk (14.20 PDI) and Sagara taluk (8.50 PDI). Among the villages, Harkere village of Shivamogga taluk recorded maximum disease intensity (16.70 PDI) followed by Devangi village of Tirtahalli taluk (14.20 PDI) and Balegaru village of Sagara taluk (8.50 PDI).

Maximum mean disease intensity was observed at 10.75 PDI in Belagavi district. In the three taluks surveyed, *viz*., Belagavi, Hukkeri and Gokak, Belagavi taluk recorded the maximum disease intensity (23.20 PDI) followed by Gokak taluk (13.65 PDI). In contrast no disease incidence was found in Hukkeri taluk. Further, Benakanahalli village of Belagavi taluk recorded maximum disease intensity of 23.20 PDI, while Shippur village of Hukkeri taluk recorded no disease incidence.

In Uttara Kannada district survey study revealed a mean disease intensity of 29.37 PDI was recorded. Among the three taluks surveyed, the maximum intensity of the disease was recorded in Anagod village (35.60 PDI) of Yallapura. Similarly in Mundagod taluka, Chawdahalli village recorded the disease intensity of 30.20 PDI and in Sirsi taluk the maximum disease intensity was recorded in Barur village (22.30 PDI).

Intensity of alternaria leaf blight disease during 2019

Roving survey was conducted in 51 villages of 30 taluks covering 12 districts of Karnataka during 2019. Among the villages surveyed, the maximum disease intensity was observed in Ilawla village of Mysuru taluk (38.80 PDI) and minimum intensity (1.50 PDI) was recorded in Shippur village of Hukkeri taluk of Belagavi district and Belamagi village of Aland taluk of Kalaburagi district. Maximum mean disease intensity at taluk level was recorded in Mysuru taluk (38.80 PDI), whereas minimum disease intensity was recorded in Hukeri taluk (1.50 PDI) of Belagavi district. At district level, maximum mean disease intensity was recorded in Mysuru district with 39.50 PDI while minimum intensity was observed in Yadgiri district with 3.20 PDI.

A roving survey conducted in Bidar district revealed a mean disease intensity of 10.36 PDI. In two taluks surveyed, Humnabad and Basavakalyana recorded mean taluk level disease intensity of 10.15 and 17.20 PDI, respectively. Among the villages maximum disease intensity was recorded Boshaga village (18.70 PDI) followed by Bettegera village (15.70 PDI) of Basavakalyana taluk. In Humnabad taluk, Nirna village recorded maximum disease intensity of 14.50 PDI followed by Hipparga village with 5.80 PDI.

Mean disease intensity in Kalaburagi district was recorded at 17.88 PDI during the survey. Among the four taluks surveyed, *viz*., Aland, Chincholi, Jewargi and Kalaburagi, Chincholi taluka recorded the maximum disease intensity (24.59 PDI) followed by Jewargi taluk (15.20 PDI). However, Kalaburagi and Jewargi taluks recorded the mean disease intensity of 3.70 and 15.20 PDI, respectively. Among the villages, Tajilapur village of Chincholi taluk recorded maximum disease intensity of 24.58 PDI, followed by Chimmanchod village of Chincholi taluk (27.50 PDI). In Alanda taluk, maximum disease intensity was observed in Mogha village at 15.75 PDI, followed by Jawalaga village (8.60 PDI).

In Yadgiri district, Doranahalli village of Shahapur taluk recorded the disease intensity of 3.20 PDI which is also the mean disease intensity at district level.

In Raichur district, the mean disease intensity was recorded at 15.00 PDI. In two taluks surveyed, Lingasugur taluk recorded maximum disease intensity of 22.50 PDI followed by Sindhanur taluk (10.35 PDI). Among the villages surveyed, Machanur village of Lingsugur taluk recorded maximum disease intensity of 22.50 PDI followed by Badlapur village of Sindhanur taluk (18.70 PDI).

In Koppal district, the mean disease intensity was recorded at 7.00 PDI. Three taluks Karatagi, Kustagi and Yelaburga were surveyed with mean disease intensity of 8.50, 8.20 and 2.60 PDI, respectively. Among the villages surveyed, Dothihal village of Kustagi taluk (8.50 PDI), followed by Joratagi village of Karatagi taluk (8.20 PDI) and Bewoor village of Yelaburga taluk (2.60 PDI).

The mean disease intensity in Bagalkot district was recorded at 6.75 PDI. In three taluks surveyed, Bagalkot taluka recorded the maximum disease intensity of 10.06 PDI followed by Mudhool taluk (5.40 PDI) and Jamkhandi taluk (4.70 PDI). Among the villages, Domanal village of Bagalkot taluk recorded maximum disease intensity at 13.50 PDI followed by Bewoor village at 12.20 PDI. In Mudhool taluk Dhawaleshwara village recorded maximum intensity at 7.60 PDI. In Jamkhandi taluk, Hippargi and Kurgodu village observed disease intensity of 5.20 and 4.20 PDI, respectively.

A roving survey conducted in Mysuru district revealed a mean disease intensity of 31.87 PDI. Across the district Mysuru taluk recorded maximum mean disease intensity of 38.80 PDI followed by Piriyapatna taluk 33.20 PDI and Hunasuru taluk 23.60 PDI. Among the villages surveyed, Ilawala village of Mysuru taluk recorded maximum disease intensity of 38.80 PDI followed by Piriyapatna Kasaba and Hunsur Kasaba with 33.20 and 23.60 PDI, respectively.

In Kodagu district, maximum mean disease intensity was observed with 10.27 PDI. Across the three taluks, Madikeri taluk observed maximum disease intensity of 15.80 PDI, followed by Somvarpete and Virajpete taluk with 7.80 and 7.20 PDI. Among the villages surveyed, Kalooru of Madikeri taluk recorded maximum disease intensity of 15.80 per cnet followed by Neergunda village of Somvarpete taluk with 7.80 PDI.

The mean disease intensity in Chamarajanagar district was recorded at 20.53 PDI. Across the two taluks, Chamarajnagar taluk recorded maximum mean disease intensity of 23.00 PDI followed by Gundlupete taluk at 22.80 PDI. In Chamarajnagar taluk, Chickbegur village observed maximum disease intensity of 38.80 PDI followed by Hanchipura village of Gundlupet taluk recorded disease intensity of 22.80 PDI.

A roving survey conducted in Shivamogga district revealed a mean disease intensity of 11.27 PDI. In three taluks surveyed, *viz*., Shivamooga, Sagara and Tirthahalli. Tirthahalli taluk recorded maximum disease intensity of 13.50 PDI followed by Sagara taluk 12.50 PDI and Shivamooga taluk 7.80 PDI. Among the villages, Devangi village of Tirthahalli taluk recorded maximum disease intensity of 13.50 PDI followed by Balegaru village of sagara taluk (12.50 PDI) and Harakere village of Shivamogga taluk with 7.80 PDI.

Maximum mean disease intensity was observed at 8.80 PDI in Belagavi district. In the three taluks surveyed, *viz*., Belagavi, Hukkeri and Gokak, Belagavi taluk recorded the maximum disease intensity of 18.70 PDI followed by Gokak taluk with 7.50 PDI. In contrast, minimum disease intensity was found in Hukkeri taluk 1.50 PDI. Further, Benakanahalli village of Belagavi taluk recorded maximum disease intensity of 18.70 PDI, while Shippur village of Hukkeri taluk recorded minimum disease intensity of 1.50 PDI.

A roving survey conducted in Uttara Kannada district revealed a mean disease intensity of 27.63 PDI. Among the three taluks surveyed, the maximum intensity of the disease was recorded in Sirsi taluk with 28.70 PDI followed by Mundagod taluk 28.50 PDI and Yallapura taluk 25.70 PDI. Among the villages, Barur village recorded maximum intensity of 28.70 PDI followed by Chawdalli village of Mundagod taluk (28.50 PDI) and Anagod village of Yallapura taluk 25.70 PDI.

Status of Alternaria blight of turmeric across agroclimatic zones of Karnataka

A significant variation in disease intensity was observed across the different agroclimatic zones of Karnataka during the two years survey 2018 and 2019. Among the various zones surveyed, the Hilly Zone (Zone 9)**,** encompassing the Uttara Kannada district, recorded the highest mean disease intensity of 28.50 PDI**.** This was followed by the Southern Dry Zone (Zone 6)**,** which includes the districts of Mysuru, Kodagu and Chamarajanagara, exhibiting a comparatively lower yet substantial disease intensity of 24.34 PDI**.**

The Southern Transitional Zone (Zone 7)**,** represented by the Shivamogga district, showed a moderate level of disease intensity at 12.20 PDI**.** In contrast, the North eastern transition Zone (Zone 1) (Bidar district) and the Northern transition zone (Zone 8) (Belagavi district) recorded nearly similar intensities of 10.36 PDI and 10.75 PDI**,** respectively. The northern dry zone (Zone 3)**,** comprising Bagalkot district, exhibited a disease intensity of 6.75 PDI, while the North eastern dry zone (Zone 2)**,** covering Kalaburagi, Yadgiri, Raichur, and Koppal districts, recorded the lowest intensity of 11.28 PDI, among all the zones assessed.

The variation of disease intensity in the northern dry zones could be due to warmer and drier conditions**,** which are generally unfavourable for pathogen survival and disease spread. The prevalence of the disease was found to increase in fields where sprinkler irrigation was practiced during November-December. These findings highlight the influence of agroclimatic variation on disease distribution and emphasize the need for zone-specific disease management strategies to effectively mitigate yield losses in the affected regions (Chaube and singh 2001). The results clearly indicated that the disease intensity was markedly higher in the hilly and southern dry zones compared to the northern and north eastern dry zones. The increased incidence in the hilly and southern regions may be attributed to favourable climatic conditions, such as higher relative humidity, moderate temperatures, and extended leaf wetness periods, which are conducive to pathogen proliferation and disease development.

Table 1: Status of Alternaria leaf blight in turmeric across the agro climatic zones of Karnataka surveyed during 2018 and 2019

Agroclimatic Zone	District	Taluk	Village*	Number of fields	Variety	Percent disease index (PDI)						
						2018	Taluk Mean	District Mean	2019	Mean	District Mean	Zonal Mean
North east transition zone (Zone 1)	Bidar	Humnabad	Nirna	3	Salem	11.70	7.00	7.05	14.50	10.15	13.68	10.76
			Hipparga	2	Salem	2.30			5.80			
		Basavakalyana	Boshaga	3	Salem	7.20	7.10		18.70	17.20		
			Betegera	2	Salem	7.00			15.70			
North eastern dry zone (Zone 2)	Kalaburgi	Aland	Belamagi	3	Prabat	2.20	10.85	11.86	1.50	8.28	12.94	9.29
			Rudrawadi	2	Salem	2.70			7.30			
			Jawalaga	2	Pitambar	10.20			8.60			
			Mogha	2	Salem	28.30			15.70			
		Chincholi	Ainolli	3	Tekumpet	22.30	24.60		16.80	24.57		
			Chandrampalli	2	Bidar Local	26.53			27.33			
			Ainolli Tanda	2	Bidar Local	15.70			18.80			
			Chimmanchod	2	Bidar Local	15.80			27.50			
			Tajilapur	2	Bidar Local	30.65			33.35			
			Kodampur	2	Bidar Local	35.60			27.20			
			Degalmadi	3	Bidar Local	25.80			25.60			
			Goudanahalli	2	Bidar Local	24.40			20.00			
		Kalaburagi	Faratabad	2	Rajapura	6.20	6.20		3.70	3.70		
		Jewargi	Kellur	2	Bidar Local	5.80	5.80		15.20	15.20		
	Yadgiri	Shahapura	Dornahalli	2	Salem	7.30	7.30	7.30	3.20	3.20	3.20	
	Raichur	Sindhanur	Balaganoor	2	Salem	1.50	8.55	13.58	2.00	10.35	16.43	
			Badlapur	2	Salem	15.60			18.70			
		Lingasugur	Machanur	2	Co-1	18.60	18.60		22.50	22.50		
	Koppala	Karatagi	Juratagi	2	CLI-325	12.60	12.60	7.57	8.20	8.20	6.43	
		Kustagi	Dothihal	2	Erode	5.80	5.80		8.50	8.50		
		Yelaburga	Bewoor	3	Erode	4.30	4.30		2.60	2.60		
Northern Dry zone (Zone 3)	Bagalkot	Bagalkot	Achanur	2	Sudarshan	7.20	8.67	6.79	4.50	10.07	6.72	10.12
			Bewoor	2	Kadapa	10.20			12.20			
			Domanal	3	Kadapa	8.60			13.50			

		Mudhool	Dhavaleshwara	2	Erode	4.20	8.25		7.60	5.40		
			Mallapura	3	Erode	12.30			3.20			
		Jamkhandi	Hippargi	3	Salem	4.60	3.45		5.20	4.70		
			Kurgodu	2	Salem	2.30			4.20			
Southern dry zone (Zone 6)	Mysuru	Mysuru	Ilawala	3	Alleppy	55.20	55.20	47.13	38.80	38.80	31.87	24.34
		Piriyapatna	Piriyapatna Kasaba	3	Varuna	47.60	47.60		33.20	33.20		
		Hunasuru	Hunasuru Kasaba	2	Salem	38.60	38.60		23.60	23.60		
	Kodagu	Madikeri	kalooru	3	Salem	22.50	22.50	15.77	15.80	15.80	10.27	
		Somvarapete	Neergunda	3	Salem	16.20	16.20		7.80	7.80		
		Virajpete	Palangala	2	Prabat	8.60	8.60		7.20	7.20		
	Chamarajnagara	Chamrajnagar	Banahalli	3	Salem	14.50	21.15	18.18	7.20	23.00	22.90	
			Chickbegur	2	Salem	27.80			38.80			
		Gundlupete	Hanchipura	2	Erode	15.20	15.20		22.80	22.80		
Southern transition zone (Zone 7)	Shivamogga	Shivamogga	Harakere	3	Prabat	16.70	16.70	13.13	7.80	7.80	11.27	12.2
		Sagara	Balegaru	3	Prabat	8.50	8.50		12.50	12.50		
		Thirthahalli	Devangi	2	Prabat	14.20	14.20		13.50	13.50		
North transition zone (Zone 8)	Belagavi	Belagavi	Benakanahalli	2	Salem	23.20	23.20	12.28	18.70	18.70	9.23	10.75
		Hukkeri	Shippur	2	Prabat	0.00	0.00		1.50	1.50		
		Gokak	Bilakundi	2	Erode	11.60	13.65		6.20	7.50		
			Ningapura	2	Erode	15.70			8.80			
Hill zone (Zone 9)	Uttara Kannada	Mundagod	Chawdalli	2	Local	30.20	30.20	29.37	28.50	28.50	27.63	28.5
		Yallapura	Angod	3	Local	35.60	35.60		25.70	25.70		
		Sirsi	Barur	2	Local	22.30	22.30		28.70	28.70		

Table 2: Mean disease severity data of Alternaria leaf spot in Turmeric across districts and taluks during 2018 and 2019

District	Taluk	Percent disease index (PDI)		
		2018	2019	Mean
Bidar	Humnabad	7.00	10.15	8.58
	Basavakalyana	7.10	17.20	12.15
Kalaburgi	Aland	10.85	8.28	9.57
	Chincholi	24.60	24.57	24.59
	Kalaburagi	6.20	3.70	4.95
	Jewargi	5.80	15.20	10.50
Yadgiri	Shahapura	7.30	3.20	5.25
Raichur	Sindhanur	8.55	10.35	9.45
	Lingasugur	18.60	22.50	20.55
Koppala	Karatagi	12.60	8.20	10.40
	Kustagi	5.80	8.50	7.15
	Yelaburga	4.30	2.60	3.45
Bagalkot	Bagalkot	8.67	10.07	9.37
	Mudhool	8.25	5.40	6.83
	Jamkhandi	3.45	4.70	4.08
Mysuru	Mysuru	55.20	38.80	47.00
	Piriyapatna	47.60	33.20	40.40
	Hunasuru	38.60	23.60	31.10
Kodagu	Madikeri	22.50	15.80	19.15
	Somvarapete	16.20	7.80	12.00
	Virajpete	8.60	7.20	7.90
Chamarajnagara	Chamrajnagar	21.15	23.00	22.08
	Gundlupete	15.20	22.80	19.00
Shivamogga	Shivamogga	16.70	7.80	12.25
	Sagara	8.50	12.50	10.50
	Thirthahalli	14.20	13.50	13.85
Belagavi	Belagavi	23.20	18.70	20.95
	Hukkeri	0.00	1.50	0.75
	Gokak	13.65	7.50	10.58
Uttara Kannada	Mundagod	30.20	28.50	29.35
	Yallapura	35.60	25.70	30.65
	Sirsi	22.30	28.70	25.50

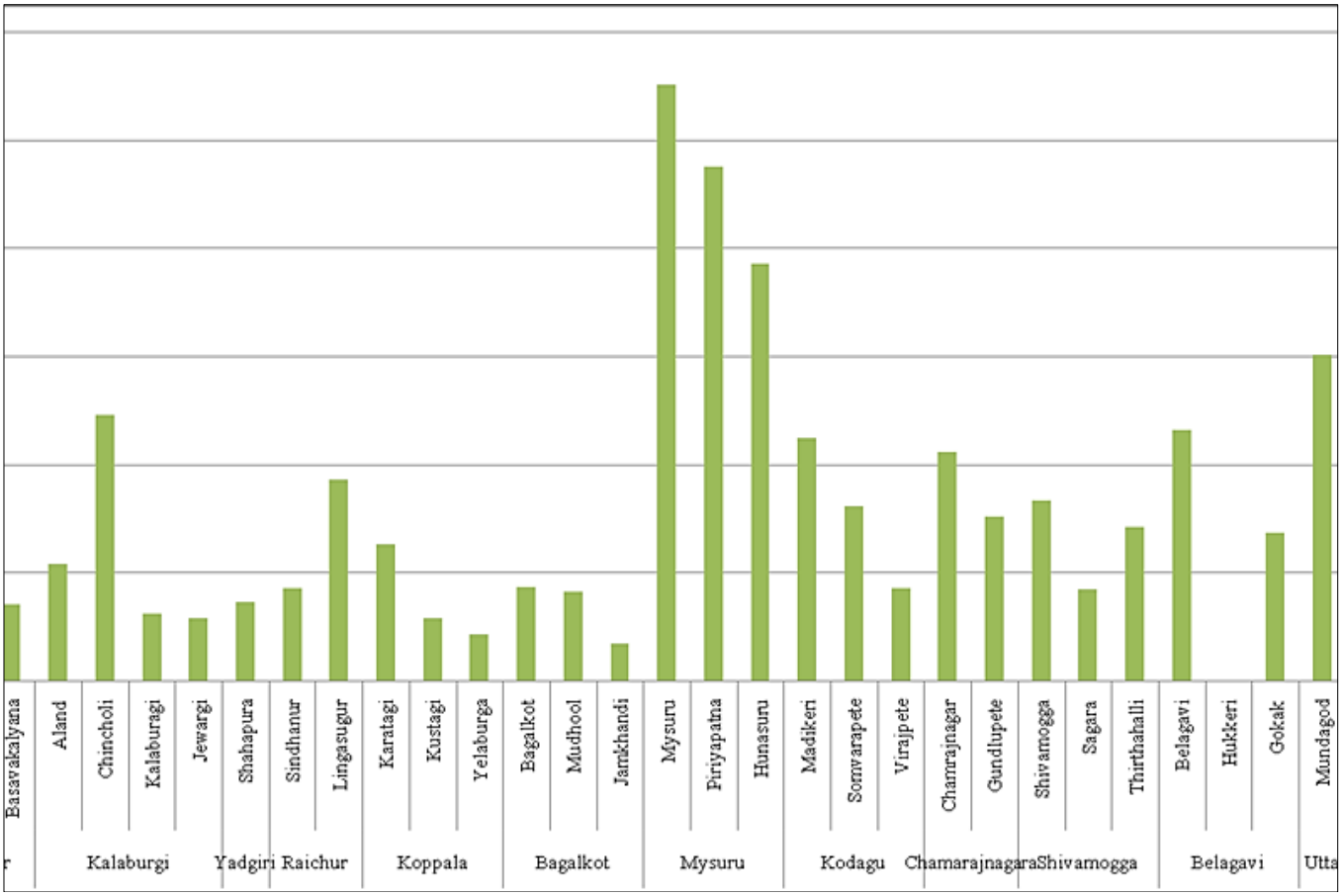

Fig 1: Mean disease severity of Alternaria leaf blight of turmeric in different taluks and districts of Karnataka during 2018

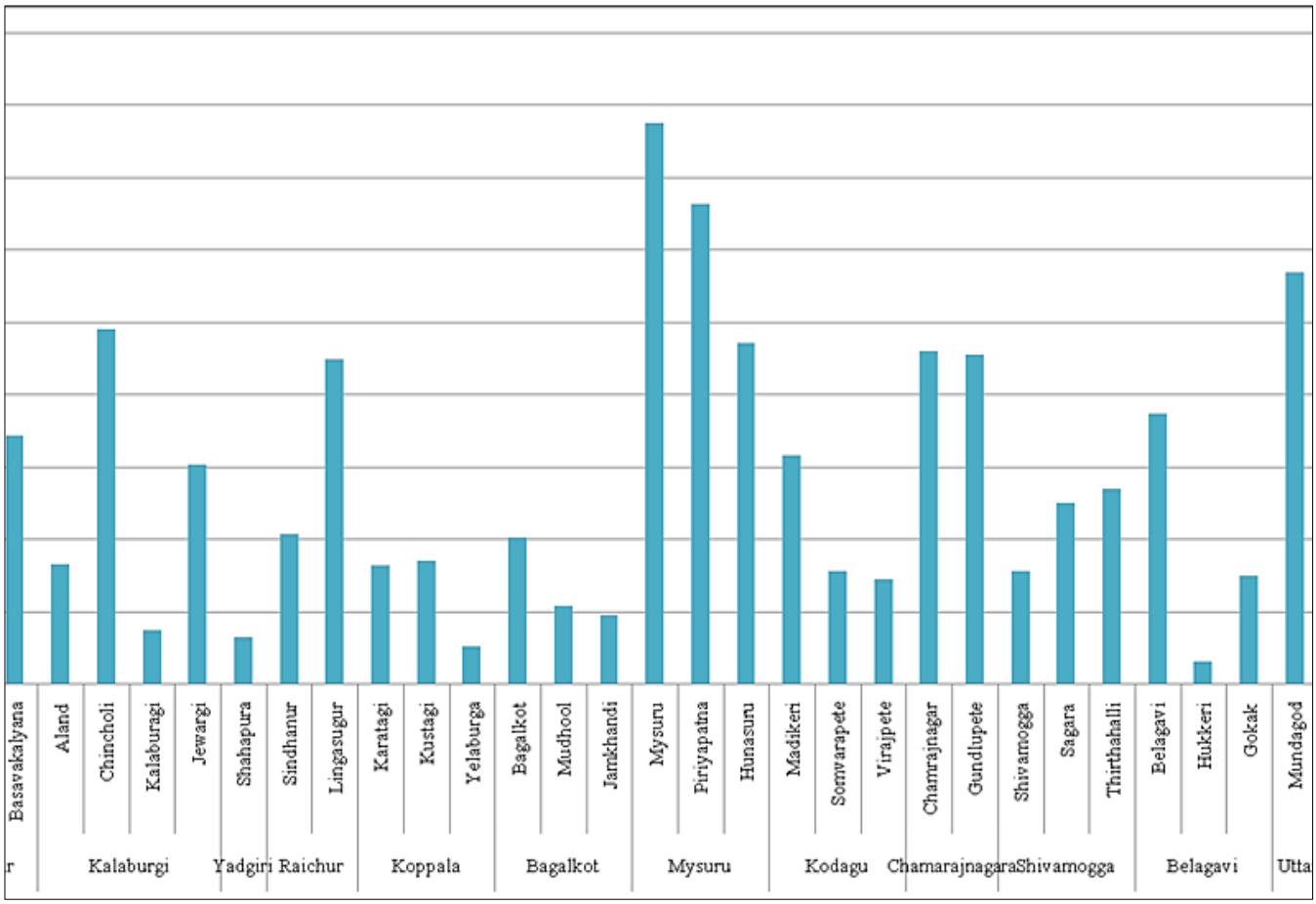

Fig 2: Mean disease severity of Alternaria leaf blight of turmeric in different taluks and districts of Karnataka during 2019

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