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STATUS AND DISTRIBUTION OF TWISTER DISEASE IN MAJOR ONION GROWING DISTRICTS OF KARNATAKA INDIA

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ABSTRACT

Onion (*Allium cepa* L.) is one of the oldest cultivated vegetable crops, cultivated three times a year. However, *Kharif* onions are severely affected by twister disease, reducing both seed and bulb quality as well as yield. Hence, a roving survey was conducted to assess the severity and distribution in major onion growing districts of Karnataka during *Kharif / Rabi* 2023 - 24 and 2024 - 25. Results revealed that the intensity of twister disease was significantly higher during *Kharif / Rabi* 2024 - 25 (10.98 PDI) compared to *Kharif / Rabi* 2023 - 24 (6.78 PDI). During *Kharif / Rabi* 2023 - 24, Kalaburagi district had the maximum per cent disease index (PDI) of 11.59, while Belagavi district had the minimum PDI of 2.47. At the taluk level, Kalagi taluk recorded the maximum mean intensity at 19.50 PDI. Among the villages surveyed, Revai village of Kalaburagi district had the maximum disease intensity at 31.11 PDI, followed by Tadkal village with 20.67 PDI. Similarly, during *Kharif / Rabi* 2024 - 25, Vijayapura district recorded the maximum mean disease intensity of 16.25 PDI. At the taluk level, Basavana Bagewadi taluk of Vijayapura district recorded the maximum mean intensity of 29.01 PDI, followed by Raichur taluk of Raichur district (18.94 PDI) and Dharwad taluk of Dharwad district (18.35 PDI). At the village level, the maximum disease intensity of 75.92 PDI was recorded in UAS, Raichur, followed by Gabbur village of Koppal taluk with 55.56 PDI. Meanwhile, several villages recorded no disease incidence. The survey results revealed marked spatial and seasonal variation in twister disease intensity across Karnataka

Keywords : Twister disease, disease intensity, roving survey, per cent disease index.

Introduction

Onion (*Allium cepa* L.), a member of the *Alliaceae* family, is the third most important horticultural crop, after potato and tomato. It is consumed worldwide, mainly for its distinctive flavour (Teshika *et al.*, 2019). India is one of the largest producers and exporters of onions, following China. In Karnataka, north and interior districts *viz.*, Dharwad, Chitradurga, Gadag, Chamarajanagar, Vijayapura,

Bagalkot, Koppal, Belagavi, Kalaburagi, Yadgir, Chikkaballapura and Haveri are major contributors to the onion production (Baraker *et al.*, 2020). In India, onions are cultivated three times a year: early and late *Kharif* seasons, accounting for 20 per cent each from July to October and December to January, respectively, with the remaining 60 per cent produced in the *Rabi* season (from December to April). Although *Kharif* onion accounts for only a minor portion of the

country's total production (approximately 20 %), it significantly influences price stability and market supply (Salunkhe *et al.*, 2022).

However, onion production is often severely affected by various biotic and abiotic factors. Several fungal diseases, including anthracnose-twister, purple blotch, downy mildew and *Stemphylium* blight, pose serious challenges for onion production and storage (Ramjegathash *et al.*, 2011; Gupta *et al.*, 2012; Sibi *et al.*, 2013; Alberto, 2014; Ratnaprabha *et al.*, 2025), reducing both seed and bulb quality as well as quantity (Nisha, 2013). Twister disease of onion remains destructive in most onion fields every cropping season, causing 80 to 100 per cent yield loss (Chawda and Rajasab, 1996; Alberto and Aquino, 2010). Since 2011, Karnataka has experienced severe outbreaks of onion anthracnose, which were attributed solely to *Colletotrichum gloeosporioides* (Rajasab and Chawda, 1994). The disease caused a huge shortage in onion supply across the country due to severe twister disease outbreaks both in Karnataka and Maharashtra during *Kharif* 2019 and 2020. This resulted in a sudden decline in onion supply and an acute shortage of seeds. The disease, predominantly caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc., was first reported by Ebenebe in 1980. Disease symptoms include anthracnose, leaf twisting, abnormal neck elongation and leaf curling. Under severe conditions, dieback symptoms are prominent, leading to drying and death of the plant. In advanced stages, infected

bulbs become slender and exhibit rotting, accompanied by a sparse and short root system, leading to the decay of both bulbs and roots (Dutta *et al.*, 2022). Thus, the present study was undertaken to assess the spatial distribution and severity of onion twister disease across different agro-ecosystems of Karnataka.

Materials and Methods

An intensive roving survey was carried out during 2023 and 2024 (*Kharif* and *Rabi*) in major onion growing areas of Karnataka, namely Bagalkote, Belagavi, Ballari, Vijayapura, Koppal, Chitradurga, Kalaburagi, Dharwad, Gadag, Bidar, Yadgir and Raichur, to assess the severity of twister disease in Karnataka. Random onion fields were selected along the survey route and within the interior areas of the villages. In each district, two to three major onion-growing taluks were chosen and a survey was conducted in eight to ten fields per district. In each field, 10 spots were selected randomly from one end of the field. The disease was then graded according to a 1 to 9 scale (Dutta *et al.*, 2022) and the disease severity was calculated.

Further, per cent disease index (PDI) was calculated by using the following formula (McKinney, 1923).

$$\text{PDI} = \frac{\text{Sum of disease ratings}}{\text{Total number of observations}} \times 100 \\ \times \text{Highest disease grade}$$

Disease rating scale for twister-anthracnose development assessment (Dutta *et al.*, 2022)

Rating Scale	Description	Corresponding damage (%)
1	Slight twisting of the neck	<10
2	Slight abnormal elongation of the neck and twisting	11 - 20
3	Twisting of the leaves with abnormal neck elongation	21 - 30
4	Twisting with severe neck elongation, with leaf curling	31 - 40
5	Severe stage of twisting, falling of plants on the ground, and the neck and foliage becoming slender	41 - 50
6	Leaf twisting and initial anthracnose lesions	51 - 60
7	Lesion advancement with fruiting body formation along with twisting	61 - 70
8	Twister anthracnose complex leading to the death of old and young leaves	71 - 80
9	Twister anthracnose complex leading to severe neck and foliage drying and defoliation, or wilting	> 81

Results and Discussion

A roving survey was conducted during *Kharif* / *Rabi* 2023 - 24 across 95 fields in nine districts of Karnataka (Bidar, Kalaburagi, Belagavi, Koppal, Chitradurga, Raichur, Ballari, Yadgir and Dharwad) to assess the prevalence and intensity of twister disease. The results showed that the intensity was generally low across the surveyed areas during the *Kharif* / *Rabi* 2023 - 24 season. However, a few villages recorded

moderate levels of disease intensity, with the overall range from 0.00 to 31.11 PDI. Among the districts, Kalaburagi district had the maximum mean disease intensity at 11.59 PDI, while Belagavi district had the minimum mean disease intensity at 2.47 PDI (Fig. 1). At the taluk level, Kalagi taluk in Kalaburagi district recorded the maximum mean intensity at 19.50 PDI and Hubballi taluk in Dharwad district showed the minimum mean intensity at 1.48 PDI. Among the

villages surveyed, Revai village of Kalaburagi district had the maximum disease intensity at 31.11 PDI, followed by Taddkal village with 20.67 PDI. In contrast, several fields across multiple districts recorded no disease incidence (Tables 1 and 3).

During *Kharif / Rabi* 2024 – 25, 140 onion fields in 12 major onion growing districts of Karnataka were assessed for the prevalence and intensity of onion twister disease. Among the districts surveyed, Vijayapura district recorded the maximum mean disease intensity of 16.25 PDI, closely followed by Raichur district (16.05 PDI) and Bagalkote district (14.22 PDI), whereas the minimum intensity was observed in Gadag district (5.18 PDI) (Fig. 1). At the taluk level, Basavana Bagewadi taluk of Vijayapura district recorded the maximum mean intensity of 29.01 PDI, followed by Raichur taluk of Raichur district (18.94 PDI) and Dharwad taluk of Dharwad district (18.35 PDI). At the village level, the maximum disease intensity of 75.92 PDI was recorded in UAS, Raichur, followed by Gabbur village of Koppal taluk with 55.56 PDI. Meanwhile, several villages such as Amminabhavi village (Dharwad district), Utnal village (Vijayapura district), Sanikere village (Chitradurga district) and Challkere village (Chitradurga district) recorded disease intensity in the range from 42.33 - 46.75 PDI. In contrast, several villages across different districts remained free from the disease (Tables 2 and 4).

A total of 95 fields were surveyed during *Kharif / Rabi* 2023 - 24, of which 23 fields were completely free from disease, while the remaining 67 fields exhibited negligible to moderate disease intensity. In contrast, during *Kharif / Rabi* 2024 - 25, a total of 140 fields were surveyed, among which 36 fields were free from disease and 104 fields showed moderate to high disease intensity. The above data reflected that 25.55 per cent of the onion fields were disease free, whereas 74.45 per cent were infected during *Kharif / Rabi* 2023 - 24. Similarly, during *Kharif / Rabi* 2024 - 25, 25.71 per cent of the fields were disease free and 74.29 per cent were infected, with comparatively higher disease intensity than the preceding year. The prevalence of twister disease thus ranged from low to moderate intensity across both seasons, reflecting spatial and temporal variations in the twister disease across various districts of Karnataka. From the pooled results of two successive years, it was ascertained that *Kharif / Rabi* 2024 - 25 had an overall maximum mean disease intensity (10.98 PDI) than *Kharif / Rabi* 2023 - 24 (6.78 PDI) (Table 3 and 4).

This increase in intensity could be attributed to the favourable environmental conditions prevailing during

the *Kharif / Rabi* 2024 - 25 season, particularly moderate temperature and high relative humidity, which are known to promote the growth, infection and sporulation of the pathogen. Moreover, the heavy and prolonged rainfall received during *Kharif / Rabi* 2024 - 25 had further accelerated the disease development by maintaining extended periods of leaf wetness and facilitating the dispersal of conidia within the crop canopy (Than *et al.*, 2008). In contrast, since twister disease is known to intensify under prolonged humid and high rainfall periods, the relatively low rainfall during *Kharif / Rabi* 2023-24 had contributed to reduced disease intensity, limiting the leaf wetness period and reducing opportunity for conidial germination and infection, thereby suppressing the overall disease development (Dutta *et al.*, 2022). The observed variations in disease intensity across seasons and locations may be attributed to differences in agroclimatic conditions, cropping patterns, rainfall distribution and environmental factors prevalent in the respective zones. These findings suggest that the interaction between host, pathogen and environmental conditions plays a pivotal role in influencing the extent and intensity of twister disease in onion-growing areas (Agrios, 2005). Further, the continuous cultivation of onion, coupled with poor crop rotation practices, has likely contributed to an increased inoculum load in the soil and plant debris, thereby facilitating the buildup and survival of the pathogen across successive seasons. Similar findings were reported by Dutta *et al.* (2022) and Dodd *et al.* (1992). In addition, frequent irrigation in certain locations increased relative humidity and created a favourable microclimate for disease development, which facilitated conidial dissemination and promoted the secondary spread of the pathogen within the field. The current results are in close agreement with the findings of Ramesh *et al.* (2025), who reported a mean disease intensity of 6.69 PDI across districts, compared to 6.78 PDI recorded in the present study during *Kharif* 2023 - 24. They reported the maximum mean disease intensity in Bagalkote district (9.63 PDI), followed by Vijayapura (10.09 PDI) and Dharwad (4.51 PDI), while Gadag district exhibited the minimum disease intensity (2.89 PDI), which aligns with the current findings, reflecting a comparable pattern of spatial variation in twister disease prevalence. However, the present findings differ from Manthesha *et al.* (2022), who reported a minimum disease intensity in Raichur district (22.88 PDI) during *Rabi* 2020 - 21, whereas in the current study, Raichur district recorded disease intensity reaching an extent of 16.05 PDI during *Kharif* 2024 - 25, although at low levels. This highlights the current status of the disease. The prevalence of twister disease,

which ranged from low to high intensity in both seasons, as reported by Barad *et al.* (2022), aligned with the findings of the present study. They further emphasized that differences in agroclimatic conditions, cropping patterns and variation in rainfall and other environmental factors across different zones are responsible for the variation in disease intensity. Sandhiya *et al.* (2025) conducted a similar study in Tamil Nadu during 2022 - 23, where the maximum disease intensity of twister blight was found in Madhuranthakam village in Chengalpattu district (47.53 %), followed by Kolathur village (38.34 %) and the minimum intensity was found in Ullavur village in Kanchipuram district (23.67 PDI). A roving survey conducted by Patil (2013) across different districts of Karnataka during 2011 - 12 reported disease intensity ranging from 2.00 to 24.05 PDI. The present findings are in close agreement with their observations, as the recorded mean disease intensity at the district level ranged from 5.18 to 16.25 PDI during the current survey.

Among the varieties and hybrids surveyed, Pancha Ganga was the most widely cultivated during the two successive years, with a mean disease intensity of 8.44 and 12.16 PDI, respectively. However, the maximum disease intensity was recorded in the hybrid Arka Kalyan, reaching 33.58 PDI during *Kharif / Rabi* 2024 - 25 (Table 5). The above data indicate only the prevailing status of twister disease as influenced by the different varieties and hybrids and not a measure of disease reaction. The observed disease intensity primarily depends on factors such as disease pressure, favourable environmental conditions and other epidemiological factors rather than on varietal susceptibility alone. Continuous cultivation of the same

varieties in the same localities over successive years promotes rapid buildup and persistence of the pathogen. When combined with favourable conditions such as moderate temperatures, high humidity and frequent irrigation, disease incidence and intensity are significantly enhanced. These findings underscore the importance of varietal selection and crop rotation in integrated disease management.

To assess the influence of soil type on disease severity, a total of 95 fields were surveyed during *Kharif / Rabi* 2023 - 24. Among them, 48 fields were under black soil and 47 fields were under red soil, with a mean disease intensity of 6.44 and 7.70 PDI, respectively. Similarly, during *Kharif / Rabi* 2024 - 25, a total of 145 fields were surveyed, comprising 98 fields under black soil and 47 fields under red soil with a disease intensity of 12.01 and 12.89 PDI, respectively.

Conclusion

The survey results revealed marked spatial and seasonal variation in twister disease intensity across Karnataka. Disease intensity was generally low across many locations during *Kharif / Rabi* 2023 - 24 but increased significantly during *Kharif / Rabi* 2024 - 25, with several locations recording severe disease intensity. The coexistence of high disease pressure and disease-free areas highlights the impact of local agroclimatic conditions and management practices, underscoring the need for continuous monitoring and an improved integrated management approach. Among the varieties/hybrids, Arka Kalyan was most susceptible to the twister disease and Pancha Ganga was widely distributed among the surveyed districts.

Table 1: Status of twister disease in major onion growing districts of Karnataka during *Kharif/Rabi* 2023-24.

Sl. No.	District	Taluk	Village	Latitude (°N)	Longitude (°E)	Method of planting	I/R*	Variety	Soil	Season	Mean PDI		
1.	Kalaburagi	Kamalapur	Kathalli	17.49736833	76.96339362	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	0.00		
				17.49747671	76.96340391	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	0.00		
			Tadkal	17.47125699	77.02721056	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	17.78		
				17.47122262	77.02721741	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	20.67		
		Taluk mean											9.61
		Kalagi	Revai	17.48993888	77.07721668	Seed sowing	I	Ellora Gold	Black	<i>Kharif</i>	31.11		
				17.48991377	77.07713055	Seed sowing	I	Ellora Gold	Black	<i>Kharif</i>	27.78		
			Watwati	17.46827472	77.03968163	Transplanted	R	Nashik Red	Black	<i>Kharif</i>	8.89		
				17.46674216	77.04541103	Transplanted	R	Nashik Red	Black	<i>Kharif</i>	10.22		
		Taluk mean											19.50
		Kalaburagi	Keribhosga	17.38152353	76.75708515	Transplanted	R	Pancha Ganga	Black	<i>Kharif</i>	8.25		
				17.44130285	76.89504373	Transplanted	I	Pancha Ganga	Black	<i>Kharif</i>	5.33		
			Awrad (B)	17.44131288	76.89502911	Transplanted	I	Pancha Ganga	Black	<i>Kharif</i>	4.67		
				17.46674216	77.04541103	Transplanted	I	Pancha Ganga	Black	<i>Kharif</i>	8.89		
				Nagoora	17.47501576	77.01019623	Seed sowing	R	Pancha Ganga	Black	<i>Kharif</i>	7.11	
		Taluk mean											6.85
District mean											11.59		
2.	Bidar	Humnabad	Talmadgi	17.77027062	77.28244179	Seed sowing	R	Pancha Ganga	Red	<i>Rabi</i>	6.78		
				17.77529488	77.28425054	Seed sowing	R	Pancha Ganga	Red	<i>Rabi</i>	15.11		

										Taluk mean	10.94				
		Bhalki	Dannura	17.98081758	77.34502939	Seed sowing	I	Local	Red	<i>Rabi</i>	12.00				
				17.98082521	77.34505687	Seed sowing	I	Local	Red	<i>Rabi</i>	15.55				
			Kosam	17.98366479	77.34428142	Seed sowing	I	Ellora Gold	Black	<i>Rabi</i>	8.89				
				17.98366124	77.34425569	Seed sowing	I	Ellora Gold	Black	<i>Rabi</i>	14.44				
			Halehipparga	18.0094761	77.34748521	Transplanted	I	Local	Black	<i>Rabi</i>	4.44				
				17.99355183	77.35111552	Seed sowing	I	Local	Black	<i>Rabi</i>	8.89				
				17.99359295	77.35130211	Seed sowing	I	Local	Black	<i>Rabi</i>	6.67				
			Kosam	17.9996646	77.35774072	Transplanted	I	Ellora Gold	Black	<i>Rabi</i>	6.67				
				17.99968554	77.35767423	Transplanted	I	Ellora Gold	Black	<i>Rabi</i>	8.89				
											Taluk mean	9.60			
										District mean	9.84				
3.	Raichur	Devadurga	Malledeverguda	16.241963	76.979841	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	0.00				
				16.274728	76.956342	Transplanted	R	Pancha Ganga	Red	<i>Kharif</i>	7.70				
					Jutmardi	16.274956	76.956684	Transplanted	R	Pancha Ganga	Red	<i>Kharif</i>	8.80		
						16.290731	76.934047	Transplanted	I	Local	Red	<i>Kharif</i>	0.00		
					Arakera	16.290794	76.934112	Transplanted	I	Local	Red	<i>Kharif</i>	0.00		
						16.286414	76.933266	Transplanted	R	Local	Red	<i>Kharif</i>	8.89		
												Taluk mean	4.23		
				Lingasugur	Neeralkere	16.14409668	76.44360355	Transplanted	I	Bhima Super	Red	<i>Kharif</i>	17.33		
						16.14402741	76.44375697	Transplanted	I	Bhima Super	Red	<i>Kharif</i>	11.11		
						16.14409281	76.44360633	Transplanted	I	Bhima Super	Red	<i>Kharif</i>	10.22		
						16.13474151	76.44536801	Transplanted	I	Bhima Super	Red	<i>Kharif</i>	0.00		
					Margatnal	16.13563126	76.43809484	Transplanted	I	Bhima Super	Red	<i>Kharif</i>	8.89		
						16.13562026	76.43809895	Transplanted	I	Bhima Super	Red	<i>Kharif</i>	13.33		
												Taluk mean	9.33		
				Raichur	Singanodi	16.217049	77.457055	Transplanted	I	Nashik Red N-53	Black	<i>Kharif</i>	5.55		
						16.215059	77.463669	Transplanted	I	Nashik Red N-53	Black	<i>Kharif</i>	0.00		
						16.21743092	77.46478964	Transplanted	I	Nashik Red N-53	Red	<i>Kharif</i>	12.89		
					Wadwati	16.20701028	77.41996203	Transplanted	R	Nashik Red N-53	Red	<i>Kharif</i>	0.00		
						16.20671279	77.42034442	Transplanted	R	Nashik Red N-53	Red	<i>Kharif</i>	6.67		
						16.20689819	77.41988942	Transplanted	R	Nashik Red N-53	Red	<i>Kharif</i>	10.00		
					Kurabdoddi	16.20810906	77.43473366	Seed sowing	R	Nashik Red N-53	Red	<i>Kharif</i>	13.75		
						16.20794606	77.43478796	Seed sowing	R	Nashik Red N-53	Red	<i>Kharif</i>	12.89		
												Taluk mean	7.72		
												District mean	7.26		
		4.	Yadgir	Shahapur	Chamnal	16.70221844	76.65610484	Seed sowing	I	Pancha Ganga	Red	<i>Kharif</i>	9.78		
						16.70219168	76.6560876	Seed sowing	I	Pancha Ganga	Red	<i>Kharif</i>	6.67		
							Gundhalli	16.7113651	77.00281594	Seed sowing	R	Local	Black	<i>Kharif</i>	10.22
								16.71138921	77.00281317	Seed sowing	R	Local	Black	<i>Kharif</i>	10.22
														Taluk mean	9.22
						Yadgir	Nagalapur	16.685919	77.255367	Transplanted	I	Hybrid	Black	<i>Kharif</i>	8.89
		16.686125	77.255145	Transplanted	R			Local	Black	<i>Kharif</i>	3.37				
										Taluk mean	6.13				
										District mean	8.19				
5.	Koppal	Yelburga	Benakal	15.358084	76.020811	Seed sowing	R	Light Red (Gavran)	Black	<i>Rabi</i>	7.70				
				15.358048	76.021065	Seed sowing	R	Light Red (Gavran)	Black	<i>Rabi</i>	0.00				
				15.351681	76.019779	Seed sowing	R	Poona Fursungi	Black	<i>Rabi</i>	0.00				
												Taluk mean	2.56		
				Koppal	Hiresindogi	15.295058	76.090381	Seed sowing	R	Bellary Light Red	Black	<i>Rabi</i>	3.33		
						15.28030552	76.10125756	Seed sowing	R	Bellary Light Red	Red	<i>Rabi</i>	5.92		
					Halagere	15.358919	76.077076	Seed sowing	R	Bellary Light Red	Black	<i>Rabi</i>	3.33		
						15.35116663	76.20581717	Seed sowing	R	Bellary Light Red	Red	<i>Rabi</i>	2.96		
					Kidadhal	15.35116389	76.20583975	Seed sowing	R	Sangam Selection	Red	<i>Rabi</i>	4.44		
						15.35123963	76.20560451	Seed sowing	R	Sangam Selection	Red	<i>Rabi</i>	0.00		
				Katarki Gudlanur	15.22541526	76.11802249	Seed sowing	R	Sangam Selection	Red	<i>Rabi</i>	5.33			
					15.22466595	76.11780986	Seed sowing	R	Sangam Selection	Red	<i>Rabi</i>	0.00			
					15.22463964	76.11779014	Seed sowing	R	Sangam Selection	Red	<i>Rabi</i>	0.00			
												Taluk mean	2.81		
										District mean	2.75				
6.	Ballari	Sandur	Bhujanganagar	15.08472314	76.56546047	Seed sowing	I	Ellora Gold	Red	<i>Kharif</i>	11.11				
				15.08500309	76.56586293	Seed sowing	R	Ellora Gold	Red	<i>Kharif</i>	0.00				
				15.08666548	76.56513174	Seed sowing	I	Bellary Red	Red	<i>Kharif</i>	13.33				
											Taluk mean	8.15			
		Siruguppa	Hagalur	15.38929382	76.90633418	Seed sowing	I	Bellary Red	Red	<i>Kharif</i>	10.22				

				15.38931919	76.9063088	Seed sowing	I	Bellary Red	Red	<i>Kharif</i>	8.89	
								Taluk mean			9.55	
	Ballari	Singadevanahalli		15.29918186	76.9115356	Seed sowing	I	Bellary Red	Red	<i>Kharif</i>	8.44	
				15.29917563	76.9115357	Seed sowing	I	Bellary Red	Red	<i>Kharif</i>	13.33	
		Dammur		15.30305641	76.92080518	Seed sowing	R	Local	Red	<i>Kharif</i>	6.00	
				15.30307681	76.92079639	Seed sowing	R	Local	Red	<i>Kharif</i>	6.89	
								Taluk mean			8.67	
								District mean			8.69	
7.	Dharwad	Dharwad	UAS, Dharwad	15.49674445	74.98527292	Transplant	I	Bhima Super	Black	<i>Rabi</i>	5.30	
				15.49667922	74.98528534	Transplant	I	Bhima Super	Black	<i>Rabi</i>	16.50	
			Thimmapur M	15.542940	75.045778	Seed sowing	R	Local	Black	<i>Rabi</i>	0.00	
			Amminabhavi	15.53783008	75.06387041	Seed sowing	R	Pancha Ganga	Black	<i>Rabi</i>	6.67	
		15.53790297		75.06385385	Seed sowing	R	Pancha Ganga	Black	<i>Rabi</i>	17.78		
									Taluk mean			9.25
		Hubballi	Nalavadi	15.364429	75.349410	Seed sowing	R	Local	Black	<i>Rabi</i>	0.00	
				15.363162	75.351901	Seed sowing	I	Bellary Red	Black	<i>Rabi</i>	0.00	
Bommapur	15.347726		75.205734	Seed sowing	R	Local	Black	<i>Rabi</i>	4.45			
								Taluk mean			1.48	
								District mean			6.33	
8.	Belagavi	Saundatti	Inamhongal	15.635985	75.062886	Seed sowing	R	Bellary Red	Black	<i>Kharif</i>	0.00	
				15.638309	75.071977	Seed sowing	R	Bellary Red	Black	<i>Kharif</i>	0.00	
			Budigoppa	15.9631883	75.0076269	Seed sowing	R	Bellary Red	Black	<i>Kharif</i>	8.14	
				15.96419783	75.00647146	Seed sowing	R	Bellary Red	Black	<i>Kharif</i>	0.00	
									Taluk mean			2.04
		Hukkeri	Yaragatti	15.96748067	75.01467993	Seed sowing	R	Bhima Super	Black	<i>Kharif</i>	0.00	
15.96740866	75.01439086			Seed sowing	R	Bhima Super	Black	<i>Kharif</i>	6.67			
								Taluk mean			3.33	
								District mean			2.47	
9.	Chitradurga	Hiriyur	Gannayakanahalli	14.014908	76.634232	Seed sowing	R	Bhima Super	Black	<i>Kharif</i>	0.00	
				14.015116	76.635158	Seed sowing	I	EWR 401	Black	<i>Kharif</i>	0.00	
				14.015134	76.635186	Seed sowing	I	EWR 401	Black	<i>Kharif</i>	0.00	
			Muddhiyappanakottige	14.070420	76.627646	Seed sowing	R	Bhima Red	Black	<i>Kharif</i>	6.60	
				14.100046	76.648481	Seed sowing	R	Bhima Red	Black	<i>Kharif</i>	3.37	
									Taluk mean			1.99
		Challakere	Sanikere	14.185317	76.666452	Seed sowing	R	Satara Selection	Red	<i>Kharif</i>	7.11	
				14.188138	76.666459	Seed sowing	R	Satara Selection	Red	<i>Kharif</i>	6.78	
			Challakere	14.286780	76.644742	Seed sowing	R	Pancha Ganga	Black	<i>Kharif</i>	10.00	
				14.285162	76.648623	Seed sowing	R	Pancha Ganga	Black	<i>Kharif</i>	7.45	
									Taluk mean			7.83
								District mean			4.59	
								Overall mean			6.86	

*I/R: Irrigated / Rainfed

Table 2: Status of twister disease in major onion growing districts of Karnataka during *Kharif/Rabi* 2024 - 25

Sl. No.	District	Taluk	Village	Latitude (°N)	Longitude (°E)	Method of planting	I/R*	Variety	Soil	Season	Mean PDI	
1.	Kalaburagi	Kamalapur	Kathalli	17.49736833	76.96339362	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	0.00	
				17.49747671	76.96340391	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	0.00	
			Tadkal	17.47125699	77.02721056	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	17.78	
				17.47122262	77.02721741	Seed sowing	R	Pancha Ganga	Red	<i>Kharif</i>	20.67	
									Taluk mean			9.61
		Kalagi	Revai	17.48993888	77.07721668	Seed sowing	I	Ellora Gold	Black	<i>Kharif</i>	31.11	
				17.48991377	77.07713055	Seed sowing	I	Ellora Gold	Black	<i>Kharif</i>	27.78	
			Watwati	17.46827472	77.03968163	Transplanted	R	Nashik Red	Black	<i>Kharif</i>	8.89	
				17.46674216	77.04541103	Transplanted	R	Nashik Red	Black	<i>Kharif</i>	10.22	
									Taluk mean			19.50
		Kalaburagi	Kalaburagi	Keribhosga	17.38152353	76.75708515	Transplanted	R	Pancha Ganga	Black	<i>Kharif</i>	8.25
					17.44130285	76.89504373	Transplanted	I	Pancha Ganga	Black	<i>Kharif</i>	5.33
				Awrad (B)	17.44131288	76.89502911	Transplanted	I	Pancha Ganga	Black	<i>Kharif</i>	4.67
					17.46674216	77.04541103	Transplanted	I	Pancha Ganga	Black	<i>Kharif</i>	8.89
					Nagoora	17.47501576	77.01019623	Seed sowing	R	Pancha Ganga	Black	<i>Kharif</i>
							Taluk mean			6.85		
								District mean			11.59	
2.	Bidar	Humnabad	Talmadgi	17.77027062	77.28244179	Seed sowing	R	Pancha Ganga	Red	<i>Rabi</i>	6.78	
				17.77529488	77.28425054	Seed sowing	R	Pancha Ganga	Red	<i>Rabi</i>	15.11	
									Taluk mean			10.94
		Bhalki	Dannura	17.98081758	77.34502939	Seed sowing	I	Local	Red	<i>Rabi</i>	12.00	
				17.98082521	77.34505687	Seed sowing	I	Local	Red	<i>Rabi</i>	15.55	
			Kosam	17.98366479	77.34428142	Seed sowing	I	Ellora Gold	Black	<i>Rabi</i>	8.89	
									Taluk mean			8.89

				17.98366124	77.34425569	Seed sowing	I	Ellora Gold	Black	Rabi	14.44	
				18.0094761	77.34748521	Transplanted	I	Local	Black	Rabi	4.44	
			Halehipparga	17.99355183	77.35111552	Seed sowing	I	Local	Black	Rabi	8.89	
				17.99359295	77.35130211	Seed sowing	I	Local	Black	Rabi	6.67	
			Kosam	17.9996646	77.35774072	Transplanted	I	Ellora Gold	Black	Rabi	6.67	
				17.99968554	77.35767423	Transplanted	I	Ellora Gold	Black	Rabi	8.89	
				Taluk mean							9.60	
				District mean							9.84	
3.	Raichur	Devadurga	Malledeverguda	16.241963	76.979841	Seed sowing	R	Pancha Ganga	Red	Kharif	0.00	
			Jutmardi	16.274728	76.956342	Transplanted	R	Pancha Ganga	Red	Kharif	7.70	
				16.274956	76.956684	Transplanted	R	Pancha Ganga	Red	Kharif	8.80	
				16.290731	76.934047	Transplanted	I	Local	Red	Kharif	0.00	
			Arakera	16.290794	76.934112	Transplanted	I	Local	Red	Kharif	0.00	
				16.286414	76.933266	Transplanted	R	Local	Red	Kharif	8.89	
					Taluk mean							4.23
		Lingasugur	Neeralkere		16.14409668	76.44360355	Transplanted	I	Bhima Super	Red	Kharif	17.33
					16.14402741	76.44375697	Transplanted	I	Bhima Super	Red	Kharif	11.11
					16.14409281	76.44360633	Transplanted	I	Bhima Super	Red	Kharif	10.22
			Margatnal		16.13474151	76.44536801	Transplanted	I	Bhima Super	Red	Kharif	0.00
					16.13563126	76.43809484	Transplanted	I	Bhima Super	Red	Kharif	8.89
				16.13562026	76.43809895	Transplanted	I	Bhima Super	Red	Kharif	13.33	
		16.13574364	76.43808084	Transplanted	I	Bhima Super	Red	Kharif	4.44			
				Taluk mean							9.33	
	Raichur	Singanodi		16.217049	77.457055	Transplanted	I	Nashik Red N-53	Black	Kharif	5.55	
				16.215059	77.463669	Transplanted	I	Nashik Red N-53	Black	Kharif	0.00	
				16.21743092	77.46478964	Transplanted	I	Nashik Red N-53	Red	Kharif	12.89	
				16.20701028	77.41996203	Transplanted	R	Nashik Red N-53	Red	Kharif	0.00	
		Wadwati		16.20671279	77.42034442	Transplanted	R	Nashik Red N-53	Red	Kharif	6.67	
				16.20689819	77.41988942	Transplanted	R	Nashik Red N-53	Red	Kharif	10.00	
		Kurabdoddi		16.20810906	77.43473366	Seed sowing	R	Nashik Red N-53	Red	Kharif	13.75	
				16.20794606	77.43478796	Seed sowing	R	Nashik Red N-53	Red	Kharif	12.89	
				Taluk mean							7.72	
			District mean							7.26		
4.	Yadgir	Shahapur	Chamnal	16.70221844	76.65610484	Seed sowing	I	Pancha Ganga	Red	Kharif	9.78	
				16.70219168	76.6560876	Seed sowing	I	Pancha Ganga	Red	Kharif	6.67	
		Gundhalli		16.7113651	77.00281594	Seed sowing	R	Local	Black	Kharif	10.22	
				16.71138921	77.00281317	Seed sowing	R	Local	Black	Kharif	10.22	
	Yadgir	Nagalapur		16.685919	77.255367	Transplanted	I	Hybrid	Black	Kharif	8.89	
				16.686125	77.255145	Transplanted	R	Local	Black	Kharif	3.37	
			Taluk mean							6.13		
			District mean							8.19		
5.	Koppal	Yelburga	Benakal	15.358084	76.020811	Seed sowing	R	Light Red (Gavran)	Black	Rabi	7.70	
				15.358048	76.021065	Seed sowing	R	Light Red (Gavran)	Black	Rabi	0.00	
				15.351681	76.019779	Seed sowing	R	Poona Fursungi	Black	Rabi	0.00	
					Taluk mean							2.56
		Koppal	Hiresindogi		15.295058	76.090381	Seed sowing	R	Bellary Light Red	Black	Rabi	3.33
					15.28030552	76.10125756	Seed sowing	R	Bellary Light Red	Red	Rabi	5.92
	Halagere			15.358919	76.077076	Seed sowing	R	Bellary Light Red	Black	Rabi	3.33	
				15.35116663	76.20581717	Seed sowing	R	Bellary Light Red	Red	Rabi	2.96	
	Kidadhal			15.35116389	76.20583975	Seed sowing	R	Sangam Selection	Red	Rabi	4.44	
				15.35123963	76.20560451	Seed sowing	R	Sangam Selection	Red	Rabi	0.00	
	Katarki Gudlanur		15.22541526	76.11802249	Seed sowing	R	Sangam Selection	Red	Rabi	5.33		
			15.22466595	76.11780986	Seed sowing	R	Sangam Selection	Red	Rabi	0.00		
		15.22463964	76.11779014	Seed sowing	R	Sangam Selection	Red	Rabi	0.00			
			Taluk mean							2.81		
			District mean							2.75		
6.	Ballari	Sandur	Bhujanganagar	15.08472314	76.56546047	Seed sowing	I	Ellora Gold	Red	Kharif	11.11	
				15.08500309	76.56586293	Seed sowing	R	Ellora Gold	Red	Kharif	0.00	
				15.08666548	76.56513174	Seed sowing	I	Bellary Red	Red	Kharif	13.33	
					Taluk mean							8.15
		Siruguppa	Hagalur		15.38929382	76.90633418	Seed sowing	I	Bellary Red	Red	Kharif	10.22
					15.38931919	76.9063088	Seed sowing	I	Bellary Red	Red	Kharif	8.89
				Taluk mean							9.55	
	Ballari	Singadevanahalli		15.29918186	76.91153356	Seed sowing	I	Bellary Red	Red	Kharif	8.44	
				15.29917563	76.91153357	Seed sowing	I	Bellary Red	Red	Kharif	13.33	
		Dammur		15.30305641	76.92080518	Seed sowing	R	Local	Red	Kharif	6.00	
				15.30307681	76.92079639	Seed sowing	R	Local	Red	Kharif	6.89	
				Taluk mean							8.67	
			District mean							8.69		

7.	Dharwad	Dharwad	UAS, Dharwad	15.49674445	74.98527292	Transplant	I	Bhima Super	Black	Rabi	5.30
				15.49667922	74.98528534	Transplant	I	Bhima Super	Black	Rabi	16.50
			Thimmapur M	15.542940	75.045778	Seed sowing	R	Local	Black	Rabi	0.00
			Amminabhavi	15.53783008	75.06387041	Seed sowing	R	Pancha Ganga	Black	Rabi	6.67
				15.53790297	75.06385385	Seed sowing	R	Pancha Ganga	Black	Rabi	17.78
										Taluk mean	9.25
		Hubballi	Nalavadi	15.364429	75.349410	Seed sowing	R	Local	Black	Rabi	0.00
				15.363162	75.351901	Seed sowing	I	Bellary Red	Black	Rabi	0.00
			Bommapur	15.347726	75.205734	Seed sowing	R	Local	Black	Rabi	4.45
										Taluk mean	1.48
								District mean	6.33		
8.	Belagavi	Saundatti	Inamhongal	15.635985	75.062886	Seed sowing	R	Bellary Red	Black	Kharif	0.00
				15.638309	75.071977	Seed sowing	R	Bellary Red	Black	Kharif	0.00
			Budigoppa	15.9631883	75.0076269	Seed sowing	R	Bellary Red	Black	Kharif	8.14
				15.96419783	75.00647146	Seed sowing	R	Bellary Red	Black	Kharif	0.00
										Taluk mean	2.04
		Hukkeri	Yaragatti	15.96748067	75.01467993	Seed sowing	R	Bhima Super	Black	Kharif	0.00
				15.96740866	75.01439086	Seed sowing	R	Bhima Super	Black	Kharif	6.67
										Taluk mean	3.33
								District mean	2.47		
9.	Chitradurga	Hiriyur	Gannayakanahalli	14.014908	76.634232	Seed sowing	R	Bhima Super	Black	Kharif	0.00
				14.015116	76.635158	Seed sowing	I	EWR 401	Black	Kharif	0.00
				14.015134	76.635186	Seed sowing	I	EWR 401	Black	Kharif	0.00
			Muddhiyappanakottige	14.070420	76.627646	Seed sowing	R	Bhima Red	Black	Kharif	6.60
			Yaraballi	14.100046	76.648481	Seed sowing	R	Bhima Red	Black	Kharif	3.37
										Taluk mean	1.99
		Challakere	Sanikere	14.185317	76.666452	Seed sowing	R	Satara Selection	Red	Kharif	7.11
				14.188138	76.666459	Seed sowing	R	Satara Selection	Red	Kharif	6.78
			Challakere	14.286780	76.644742	Seed sowing	R	Pancha Ganga	Black	Kharif	10.00
				14.285162	76.648623	Seed sowing	R	Pancha Ganga	Black	Kharif	7.45
								Taluk mean	7.83		
								District mean	4.59		
								Overall mean	6.86		

*I/R: Irrigated / Rainfed

Table 3 : Mean severity of twister disease in different taluks and districts of Karnataka during *Kharif / Rabi* 2023-24

Kharif/Rabi 2023-24			
District	Taluk	Taluk mean severity (PDI)	District mean severity (PDI)
Kalaburagi	Kamalapura	9.61	11.59
	Kalagi	19.50	
	Kalaburagi	6.85	
Bidar	Humnabad	10.94	9.84
	Bhalki	9.60	
Raichur	Devadurga	4.23	7.26
	Lingasugur	9.33	
	Raichur	6.15	
Yadgir	Shahapur	9.22	8.19
	Yadgir	6.13	
Koppal	Yelburga	2.56	2.75
	Koppal	2.81	
Ballari	Sandur	8.15	8.69
	Siruguppa	9.55	
	Ballari	8.67	
Dharwad	Dharwad	9.25	6.33
	Hubballi	1.48	
Belagavi	Saundatti	2.04	2.47
	Hukkeri	3.33	
Chitradurga	Hiriyur	1.99	4.59
	Challakere	7.83	
Overall mean			6.78

Table 4: Mean severity of twister disease in different taluks and districts of Karnataka during *Kharif/Rabi* 2024-25

Kharif/Rabi 2024-25			
District	Taluk	Taluk mean severity (PDI)	District mean severity (PDI)
Kalaburagi	Kalaburagi	5.60	12.41
	Aland	17.09	
	Kalagi	13.70	
Bidar	Bhalki	9.77	6.98
	Chittaguppa	0.00	
Raichur	Devadurga	12.44	16.05
	Raichur	18.94	
Yadgir	Shahpura	7.20	7.62
	Yadgir	8.44	
Koppal	Yelburga	8.08	10.61
	Koppal	12.09	
Ballari	Sandur	15.55	6.85
	Ballari	2.50	
Dharwad	Dharwad	18.35	14.04
	Hubballi	6.49	
Belagavi	Saundatti	6.05	7.90
	Hukkeri	8.82	
Bagalkote	Bagalkote	15.80	14.22
	Bilagi	13.70	
Vijayapura	Vijayapura	10.26	16.25
	Basavana Bagewadi	29.01	
	Kolhar	14.45	
Gadag	Mundaragi	10.00	5.18
	Gadag	2.77	
Chitradurga	Hiriyur	4.09	13.71
	Challakere	17.15	
Overall mean			10.98

Table 5 : Response of different varieties/hybrids against twister disease during the survey

Sl. No.	Variety	Kharif/Rabi 2023 - 24		Kharif/Rabi 2024 - 25	
		No. of locations	PDI	No. of locations	PDI
1	Pancha Ganga	20	8.44	30	12.16
2	Ellora Gold	08	13.61	06	16.99
3	Ellora wonder	-	-	03	26.85
4	Nashik Red N-53	05	7.51	14	6.44
5	Bhima Super	12	7.81	07	10.97
6	Arka kalyan	01	8.89	06	33.58
7	Light Red (Gavran)	02	3.85	02	3.85
8	Poona Fursungi	01	2.47	06	11.89
9	Bellary Light Red	04	3.88	09	17.86
10	Sangam Selection	05	1.95	03	1.23
11	Bellary Red	10	5.09	02	5.00
12	KSP-176	-	-	05	6.76
13	Royal Selection	-	-	05	27.52
14	Telagi Red	-	-	02	20.35
15	Super kanak	-	-	02	9.90
16	EWR 401	02	0.00	02	0.00

17	Bhima Red	02	4.98	03	5.34
18	Satara Selection	02	6.94	03	4.63
19	KSP-1770	-	-	03	3.55
20	Prema 178	-	-	02	6.05

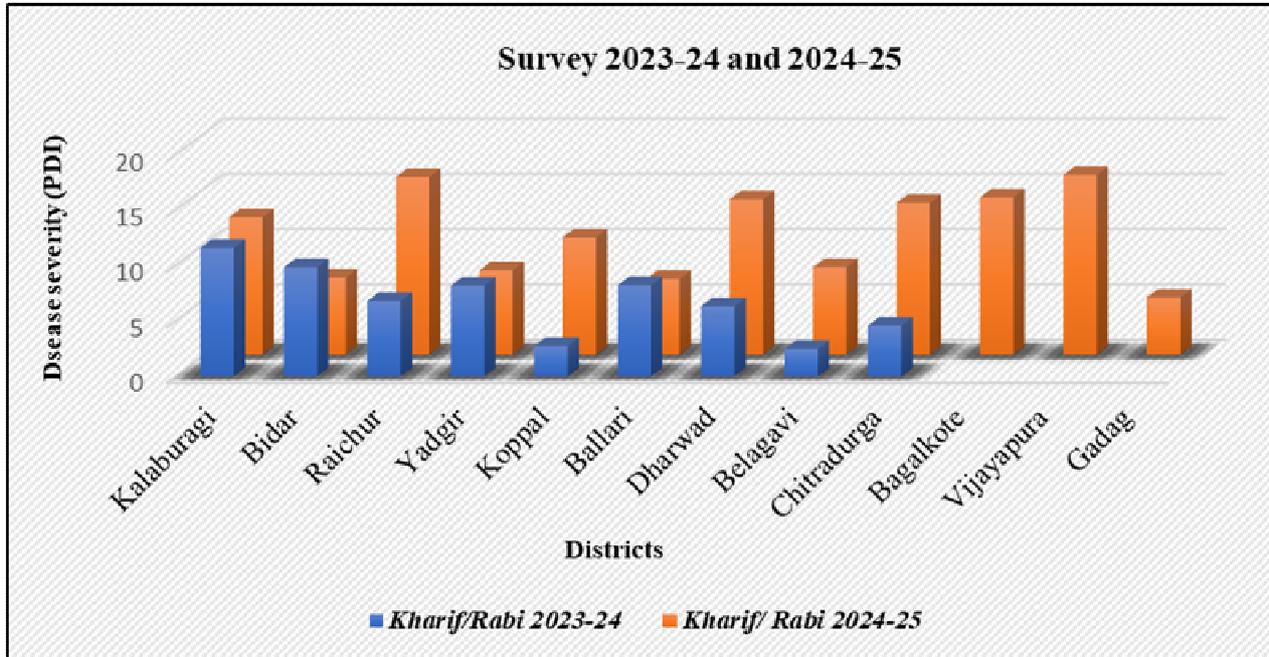


Fig. 1 : Mean severity of onion twister disease in different districts of Karnataka during *Kharif/Rabi* 2023 - 24 and 2024 - 25

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Conflicts of Interest

The author declares no conflicts of interest.

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