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Prevalence of wilt complex disease in major ginger growing regions of Karnataka during *kharif* 2023

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Abstract

Ginger is one of the important spice crops and its cultivation is affected by various constraints among which wilt complex disease causes huge losses. Hence, a roving survey was conducted to determine the incidence of ginger wilt complex disease in Bidar, Haveri, Shivamogga and Uttara Kannada districts of Karnataka. Disease incidence along with relevant field parameters were recorded during the survey. In *kharif* 2023, disease incidence ranged from 9.33% in Tavaragi (Hirekerur taluk, Haveri district) to 52.33% in Yadakoppa (Sirsi taluk, Uttara Kannada district). At the taluk level, Hanagal (Haveri district) recorded the lowest mean incidence (18.9%), while Sirsi (Uttara Kannada district) recorded the highest (39.19%). District-wise, Bidar showed the lowest mean incidence (20.73%), whereas Uttara Kannada recorded the highest (35.46%). The highest wilt complex incidence among ginger cultivars was recorded in Rio de Janeiro (31.49%). Among soil types, medium black soils showed the highest disease incidence (32.35%). Crop stage-wise, the highest incidence was observed at the vegetative stage (31.58%), indicating increased disease severity with crop advancement. Sirsi, Shivamogga and Soraba taluks were identified as hotspots for the disease.

Keywords: Ginger, percent disease incidence, roving survey, wilt complex

Introduction

Ginger (*Zingiber officinale* Rosc.) is an important spice crop cultivated in tropical and subtropical regions, valued for its culinary, medicinal, and industrial uses due to the presence of bioactive compounds such as gingerols, shogaols, and essential oils (Mao *et al.*, 2019) [8]. Despite its economic significance, productivity is often constrained by several biotic stresses that severely affect crop health and yield. Among these, the rhizome rot or wilt complex is the most destructive disease of ginger, caused by a consortium of soil-borne pathogens. Disease development is strongly influenced by environmental conditions, particularly high soil moisture, warm temperatures, and prolonged wetness, which create a conducive environment for pathogen proliferation (Dohroo, 2005) [5]. The disease is especially prevalent in humid and high-rainfall regions such as Kerala, Karnataka, Assam, and Sikkim, where waterlogging during the monsoon period exacerbates disease incidence (Stirling *et al.*, 2009; Tejaskumar *et al.*, 2023; Dey *et al.*, 2025) [15, 16, 4]. Yield losses due to rhizome rot have been reported to range from 20% to 100%, depending on disease severity and environmental conditions (Acharya *et al.*, 2016; Archana *et al.*, 2024) [1, 3]. The soil-borne nature of the causal organisms further complicates effective disease management.

Major pathogens associated with wilt complex of ginger include *Pythium* spp., which induce soft rot; *Fusarium oxysporum*, responsible for yellows or wilt; and *Ralstonia solanacearum*, which causes bacterial wilt (Elliott, 2003) [6]. In addition, *Sclerotium rolfsii* may cause basal rot later in the crop cycle. These organisms frequently interact with nematodes, creating disease complexes that intensify symptom severity. Such interactions also make the plants more vulnerable to secondary infections (Sarma, 1994) [12]. Keeping the destructive nature of the disease in consideration roving survey was conducted during *kharif* 2023, which helps in identifying the hotspots and enabling timely and location-specific management strategies.

Materials and Methods

A roving survey was conducted during *kharif* 2023 to assess the prevalence of wilt complex disease in major ginger-growing districts of Karnataka, namely Haveri, Shivamogga, Uttara Kannada, and Bidar. During the survey, observations on disease incidence along with relevant parameters such as village, taluk, district, soil type, crop stage, variety, and GPS location were systematically recorded. Plant samples exhibiting typical disease symptoms were collected and brought to the laboratory for isolation and identification of pathogens associated with the rhizome rot complex. The percent disease incidence (PDI) was calculated using the formula proposed by Wheeler (1969) [17].

$$\text{Percent Disease Incidence (PDI)} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \times 100$$

Results

The percentage disease incidence of ginger wilt complex across the four surveyed districts ranged from 9.33 percent in Tavaragi village of Hirekerur taluk (Haveri district) to 52.33 percent in Yadakoppa village of Sirsi taluk (Uttara Kannada district) (Table 1). In Haveri district, the lowest disease incidence was recorded in Tavaragi village (9.33%) of Hirekerur taluk, whereas the highest incidence was observed in Guddada Malapura village (38.50%) of Byadgi taluk. In Uttara Kannada district, Nyasargi village in Mundgod taluk registered the lowest incidence at 22.00 percent, while the highest incidence of 52.33 percent was reported from Yadakoppa village in Sirsi taluk. In Shivamogga district, Ayanur village (25.33%) in Shivamogga taluk showed the lowest disease incidence, whereas the highest incidence (41.87%) was recorded in Shikaripura of Shikaripura taluk. In Bidar district, Kambalewadi village of Basavakalyan taluk documented the lowest incidence at 18.75 percent, while the highest incidence of 25.15 percent was observed in Chitguppa village of Humnabad taluk. Among the twelve taluks surveyed, the lowest mean disease incidence was recorded in Hanagal taluk of Haveri district (18.9%), while the highest mean incidence was observed in Sirsi taluk of Uttara Kannada district (39.19%). District-wise analysis revealed that Bidar district exhibited the lowest average disease incidence (20.73%), whereas Uttara Kannada district recorded the highest mean incidence (35.46%) (Table 1).

During the *kharif* 2023 survey, five ginger cultivars were recorded across the surveyed districts. Among these, the cultivar Rio de Janeiro showed the highest incidence of ginger wilt complex, with a mean disease incidence of 31.49%. In contrast, the improved variety IISR Varada exhibited the lowest disease incidence, recording a mean of 18.00%, indicating comparatively better tolerance to the disease under field conditions (Table 2).

Four different soil types were recorded across the surveyed districts, among which medium black soils exhibited the highest mean disease incidence of wilt complex at 32.35% (Table 3).

With respect to crop stages, the disease incidence was lowest at the seedling stage (19.51%), increased during the

tillering stage (28.56%), and reached its peak at the vegetative stage (33.81%), indicating a progressive increase in disease severity with crop growth (Table 4).

Discussion

The high incidence of ginger wilt complex disease was observed in Sirsi, Shivamogga and Soraba taluks, it may be attributed to high rainfall, prolonged soil moisture, poor drainage, and lateritic soil conditions, which are highly conducive for soil-borne pathogens such as *Pythium spp.* and *Fusarium spp.* These pathogens thrive under saturated soil conditions and rapidly infect ginger rhizomes, leading to severe disease outbreaks. Similar findings have been reported from the Western Ghats region, where high humidity and continuous cropping favour the buildup of rhizome rot pathogens. The results obtained are supported by earlier reports. Shalini (2008) [14] reported that during the 2004-05 cropping season the incidence of rhizome rot complex varied widely from 5.50 to 45.60 percent. Among the surveyed districts, Uttara Kannada recorded the highest mean disease incidence (22.30%), whereas the lowest incidence was observed in Bidar district (13.00%). Rekha *et al.* (2015) [10] also reported that Uttara Kannada district showed the maximum disease incidence (28.16%), while Hassan district recorded the minimum incidence (15.20%). Similarly, Nagaraja and Krishnappa (2017) [9] documented that surveys conducted during 2014-15 and 2015-16 recorded the highest disease incidence in Shivamogga district, with values of 29.54% and 30.56%, respectively, whereas the lowest incidence during these years was reported in Bidar district with 15.87% and 17.74%. Mahesha *et al.* (2020) [7] further observed that during 2016 Uttara Kannada district recorded the highest mean rhizome rot incidence (33.20%), while Mysore district showed the lowest incidence (18.84%). However, in 2017 the maximum disease incidence (44.66%) was reported in Sagara taluk of Shivamogga district, whereas the minimum incidence (22.67%) occurred in Piriapatna taluk of Mysore district. Tejaskumar *et al.* (2023) [16] also reported that among the surveyed districts Uttara Kannada recorded the highest disease incidence (31.62%), followed by Shivamogga district (28.81%), while the lowest incidence was observed in Haveri district (25.45%).

Earlier studies conducted in Karnataka have documented cultivar-dependent differences in wilt and rhizome rot incidence, emphasizing that traditional and improved cultivars such as Humnabad local and IISR Varada possess comparatively better tolerance to the wilt complex pathogens (Shalini, 2006; Nagaraja and Krishnappa, 2017) [13, 9]. Higher incidence of rhizome rot and wilt complex was consistently associated with poorly drained black soils (Rekha *et al.*, 2016; Mahesha *et al.*, 2020) [11, 7]. In contrast, the lowest incidence was observed in lateritic red soils, recording 21.16%. The progressive increase in disease incidence with crop age may be attributed to the gradual build-up of pathogen inoculum in the soil, increased root and rhizome surface area providing more infection courts, and greater physiological stress during active vegetative growth (Anandaraj and Sarma, 1995; Mahesha *et al.*, 2020) [2, 7].

Table 1: Survey for the incidence of wilt complex disease in major ginger growing regions of Karnataka during *kharif* 2023

District	Taluk	Village	Soil type	Variety	Crop Stage	GPS Readings		Percent Disease Incidence	Other diseases observed
						Latitude	Longitude		
Haveri	Hirekerur	Kachavi	Red loamy	Himachal	Seedling	14°35'03"N	75°15'12"E	15.00	Leaf spot
		Purapundikoppa	Red loamy	Rio de Janeiro	Tillering	14°35'15"N	75°13'27"E	22.33	-
		Tavaragi	Red loamy	IISR Varada	Seedling	14°27'29"N	75°25'19"E	9.33	-
		Channalli	Red loamy	Himachal	Tillering	14°24'18"N	75°22'20"E	14.67	-
		Kalagonda	Red loamy	Rio de Janeiro	Seedling	14°29'34"N	75°25'18"E	25.00	-
		Divagihalli	Medium black	Rio de Janeiro	Seedling	14°32'05"N	75°23'04"E	15.67	-
		Chikbudihal	Red loamy	Himachal	Tillering	14°33'02"N	75°25'38"E	21.67	Leaf spot
		Muddinakoppa	Red loamy	Rio de Janeiro	Tillering	14°34'38"N	75°19'50"E	35.33	Leaf spot
	Taluk mean							19.88	
	Byadgi	Muttur	Red loamy	Himachal	Seedling	14°36'44"N	75°21'33"E	23.00	-
		Hirehalli	Red	Himachal	Seedling	14°38'34"N	75°19'24"E	26.67	-
		Dhullikoppa	Red loamy	Himachal	Tillering	14°36'01"N	75°21'16"E	28.00	-
		Guddada Malapura	Red loamy	Rio de Janeiro	Tillering	14°35'46"N	75°16'17"E	38.50	-
		Kadaramandalagi	Red	Himachal	Seedling	14°38'15"N	75°30'49"E	16.50	Mosaic
	Taluk mean							26.53	
	Hanagal	Akki Alur	Red	Himachal	Seedling	14°43'54"N	75°10'29"E	22.50	-
		Balambeed	Red	Rio de Janeiro	Seedling	14°45'51"N	75°12'42"E	21.67	-
		Nellikoppa	Red loamy	Himachal	Tillering	14°38'52"N	75°22'04"E	13.5	-
		Balur	Red	Himachal	Tillering	14°43'25"N	75°08'41"E	18.50	-
		Tilavalli	Red loamy	IISR Varada	Seedling	14°39'29"N	75°21'13"E	18.33	-
	Taluk mean							18.90	
	District mean							21.45	
Uttara Kannada	Sirsi	Banavasi	Medium black	Himachal	Vegetative	14°32'04"N	75°00'42"E	33.33	Leaf spot
		Yadiyurbailu	Red	Himachal	Vegetative	14°31'43"N	75°01'39"E	49.67	Leaf spot
		Yadakoppa	Medium black	Rio de Janeiro	Vegetative	14°31'10"N	75°01'33"E	52.33	Leaf spot
		Halsinakoppa	Red	Rio de Janeiro	Tillering	14°35'44"N	74°54'50"E	46.67	Leaf spot
		Bilur	Red	Sirsi local	Tillering	14°40'03"N	74°57'16"E	32.67	Leaf spot
		Andagi	Medium black	Himachal	Vegetative	14°36'37"N	75°00'51"E	28.00	Leaf spot
		Vadla (Waddal)	Medium black	Himachal	Tillering	14°40'15"N	75°01'17"E	31.67	Leaf spot
	Taluk mean							39.19	
	Mundgod	Hirehalli	Red	Sirsi local	Tillering	14°53'58"N	75°02'20"E	25.67	-
		Nyasargi	Red loamy	Himachal	Vegetative	14°59'10"N	75°03'43"E	22.00	Leaf spot
		Nandipura	Red	Rio de Janeiro	Vegetative	14°59'45"N	75°01'39"E	41.66	Leaf spot
		Bachanaki	Medium black	Himachal	Tillering	15°00'14"N	75°03'24"E	31.00	Leaf spot
		Salgoan	Red loamy	Himachal	Tillering	14°55'17"N	75°02'09"E	38.33	Leaf spot
	Taluk mean							31.73	
	District mean							35.46	
Shivamogga	Sagara	Narasipura	Red loamy	Himachal	Vegetative	14°07'35"N	75°13'40"E	26.33	-
		Gowthamapura	Red loamy	Himachal	Vegetative	14°08'17"N	75°13'39"E	29.67	Leaf spot
		Arasalu	Medium black	IISR Varada	Vegetative	13°59'51"N	75°18'43"E	26.33	Leaf spot
		Sampalli	Medium black	Humnabad local	Tillering	13°57'38"N	75°13'51"E	28.67	Leaf spot
		Tavarehalli	Red loamy	Rio de Janeiro	Tillering	14°04'15"N	75°11'43"E	37.33	Anthraco nose
		Tyagarthi	Red loamy	Himachal	Vegetative	14°11'52"N	75°10'55"E	32.00	-
	Taluk mean							30.06	
	Shivamogga	Ayanur	Red	Himachal	Vegetative	14°00'25"N	75°26'11"E	25.33	-
		Tavarekoppa	Medium black	Himachal	Tillering	13°57'00"N	75°25'14"E	39.50	Leaf spot
		Harnahalli	Medium black	Rio de Janeiro	Tillering	14°02'26"N	75°27'38"E	32.25	-
		Channanahalli	Red	Himachal	Vegetative	13°58'21"N	75°26'47"E	36.67	Leaf spot
		Kumsi	Medium black	Himachal	Tillering	14°03'24"N	75°23'48"E	33.25	-
	Taluk mean							33.40	
	Shikaripura	Kalmane	Red	Rio de Janeiro	Tillering	14°06'56"N	75°21'38"E	30.60	Leaf spot
		Shikaripura	Red loamy	Himachal	Vegetative	14°16'22"N	75°20'32"E	41.87	Leaf spot
		Balligavi	Red loamy	Himachal	Vegetative	14°23'50"N	75°14'22"E	29.10	-
		Shiralkoppa	Red loamy	Himachal	Tillering	14°23'14"N	75°14'57"E	27.33	-
		Thadagani	Red	Rio de Janeiro	Tillering	14°21'29"N	75°15'12"E	29.67	Anthraco nose
	Taluk mean							31.71	
	Soraba	Anavatti	Red loamy	Himachal	Vegetative	14°33'02"N	75°09'35"E	36.67	-
		Puttanahalli	Red	Rio de Janeiro	Vegetative	14°30'19"N	75°04'01"E	30.00	Leaf spot
		Dyavanahalli	Red loamy	Himachal	Tillering	14°29'25"N	75°03'41"E	26.67	Leaf spot
		Gudavi	Medium black	Rio de Janeiro	Tillering	14°26'40"N	75°01'01"E	36.25	-
	Taluk mean							32.40	
	District mean							31.77	

Bidar	Basavakalyan	Islampura	Lateritic red	Humnabad local	Tillering	17°47'07"N	77°00'41"E	22.15	-
		Kamblewadi	Red	Humnabad local	Seedling	17°48'16"N	76°50'04"E	18.75	-
		Kitta	Lateritic red	Humnabad local	Seedling	17°52'33"N	77°00'39"E	22.57	Leaf spot
	Taluk mean							21.16	
	Bidar	Chidri	Lateritic red	Rio de Janeiro	Tillering	17°54'19"N	77°29'35"E	19.35	Leaf spot
		Indiranagar	Lateritic red	Humnabad local	Tillering	17°45'22"N	77°11'14"E	20.86	-
		Honnakeri	Lateritic red	Humnabad local	Seedling	17°58'18"N	77°24'25"E	19.10	-
	Taluk mean							19.77	
	Humnabad	Chitguppa	Red	Humnabad local	Tillering	17°41'49"N	77°12'27"E	25.15	-
		Hudagi	Lateritic red	Humnabad local	Seedling	17°45'46"N	77°09'58"E	23.33	-
		Muthangi	Red	Humanbad local	Seedling	17°39'32"N	77°19'24"E	15.25	-
		Bannalli	Lateritic red	Rio de Janeiro	Tillering	17°41'55"N	77°15'53"E	20.75	-
	Taluk mean							21.12	
	District mean							20.73	

Table 2: Incidence of rhizome rot complex disease in different cultivars of ginger

Cultivar	Mean percent disease incidence
Himachal	28.22
Humnabad local	21.76
IISR Varada	18.00
Rio de Janeiro	31.49
Sirsi local	29.17

Table 3: Influence of soil type on incidence of wilt complex disease in ginger

Soil type	Mean percent disease incidence
Red	28.53
Red loamy	26.61
Lateritic red	21.16
Medium black	32.35

Table 4: Incidence of wilt complex disease of ginge

Crop stage	Mean percent disease incidence
Seedling	19.51
Tillering	28.56
Vegetative	33.81

Conclusion

The roving survey conducted during *kharif* 2023 revealed that wilt complex disease is widely prevalent across major ginger-growing regions of Karnataka, with its incidence significantly influenced by cultivar, soil type, and crop growth stage. Sirsi, Soraba and Shivamogga taluks were identified as hotspots. Higher disease incidence was observed in the cultivar Rio de Janeiro, medium black soils, and at the vegetative stage, whereas comparatively lower incidence was recorded in IISR varada, lateritic red soils, and at the seedling stage. Overall, the findings highlight the importance of selecting tolerant cultivars and adopting location-specific management practices, particularly during advanced crop stages, to effectively mitigate disease severity.

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