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RESEARCH PAPER

Survey on the prevalence of Pokkah boeng disease of maize caused by *Fusarium* species in Karnataka

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Abstract: Maize (*Zea mays* L.), a major cereal crop and a key component of global food and feed systems, faces increasing productivity threats from fungal diseases. Among these, Pokkah boeng, caused by the *Fusarium* species complex, has gained prominence in warm and humid maize-growing regions. To assess the prevalence and distribution of Pokkah boeng in northern Karnataka, a systematic roving survey was conducted during the *kharif*, *rabi* and summer seasons across five major maize-growing districts, Belagavi, Davangere, Dharwad, Gadag and Haveri. Disease incidence varied significantly across locations, ranging from 11.99 to 37.67 per cent, with Belagavi showing the highest mean incidence (25.22%) and Davangere the lowest (17.68%). Higher incidence was associated with black soils, irrigated conditions and intercropping with sorghum or sugarcane. The disease was most severe during the *kharif* season, coinciding with warm and humid conditions favourable for *Fusarium* infection. The study establishes baseline data on Pokkah boeng occurrence in Karnataka and underscores the influence of climatic, edaphic and cropping factors on its prevalence, providing critical inputs for disease management.

Key words: *Fusarium*, Karnataka, Maize, Pokkah boeng, Survey

Introduction

Maize (*Zea mays* L.) is one of the most extensively cultivated cereal crops globally and serves as a cornerstone of global agriculture. Domesticated from teosinte in Central America approximately 9,000 years ago, maize has played a pivotal role in the evolution of human civilizations (Sawers and Leon, 2011). Today, it remains a staple food for billions, providing a major source of energy and nutrients. Beyond its dietary importance, maize is also a critical industrial raw material used in livestock feed, biofuel production and starch-based industries, including the manufacture of high-fructose corn syrup. Its broad genetic diversity and adaptability to varied agro-climatic conditions have also made it an important model organism for genetic, physiological and breeding research.

Despite its global and national importance, maize production is constrained by several abiotic and biotic stresses that significantly reduce yield and grain quality. Among the biotic constraints, fungal diseases caused by *Fusarium* species have emerged as major challenges in recent years. Pokkah boeng, an emerging disease caused by members of the *Fusarium* species complex, has become increasingly prevalent in warm and humid maize-growing regions. The disease is characterized by chlorosis along leaf margins, twisting and distortion of upper leaves, and, in severe cases top rot, which can lead to substantial yield losses (Sajeev *et al*., 2025). Furthermore, as several *Fusarium* species are capable of producing mycotoxins such as fumonisins, the occurrence of Pokkah boeng also raises significant concerns regarding food and feed safety.

In India, maize cultivation is rapidly expanding across diverse agro-climatic zones, including Karnataka, where favourable environmental conditions may promote the development and spread of *Fusarium*-associated diseases. However, systematic data on the prevalence and distribution of Pokkah boeng in maize and this region remain limited. Therefore, a field survey was conducted to assess the incidence and severity of Pokkah boeng disease in major maize-growing areas of Karnataka. The study aims to generate baseline information on disease occurrence under local field conditions, which is essential for understanding regional disease dynamics, identifying susceptible hybrids, and developing effective management strategies.

Material and methods

A systematic random roving survey was conducted during the *kharif*, *rabi* and summer cropping seasons of 2024-25 across the major maize-growing districts of northern Karnataka, namely Belagavi, Davangere, Dharwad, Gadag and Haveri, to determine the prevalence and incidence of Pokkah boeng disease (Fig. 1).

Within each selected taluk, two to four representative villages were surveyed depending on the extent of maize cultivation. In each village, fields under active maize cultivation were randomly chosen for observation. From each field, four quadrants measuring 10 m² were demarcated to record disease incidence. The number of visibly infected plants in each quadrant was counted, and the disease incidence (DI) was calculated using the formula proposed by Wheeler (1969):

$$\text{Disease incidence} = \frac{\text{Total number of plants infected}}{\text{Total number of plants observed}} \times 100$$

Relevant information such as field location, crop variety, and cropping history was also recorded during the survey. Characteristic disease symptoms, including leaf margin chlorosis, wrinkling, twisting of upper leaves, and top rot, were documented to confirm Pokkah boeng occurrence.

Results and discussion

The survey conducted across the major maize-growing districts of northern Karnataka revealed a variable incidence of Pokkah boeng disease, ranging from 11.99 to 37.67 per cent (Table 1). The highest incidence was recorded in Inchal village of Belagavi district (37.67%), while the lowest was observed in Hukkeri village (11.99%). Among taluks, Ramdurg recorded the highest mean incidence (28.67%), whereas Savanur showed the lowest (14.00%). Across districts, Belagavi exhibited the highest mean incidence (25.22%), followed by Gadag (24.15%), while Davangere recorded the lowest (17.68%). The overall mean disease incidence across locations was 22.78 per cent (Fig. 2).

Disease severity varied considerably among districts, which could be attributed to differences in climatic conditions, cropping patterns, soil types and varietal susceptibility. The highest incidences were recorded in regions characterized by warm and humid weather, particularly during the *kharif* season, conditions that favour *Fusarium* infection and sporulation.

In most surveyed locations, typical Pokkah boeng symptoms such as wrinkling, twisting and rolling of leaves

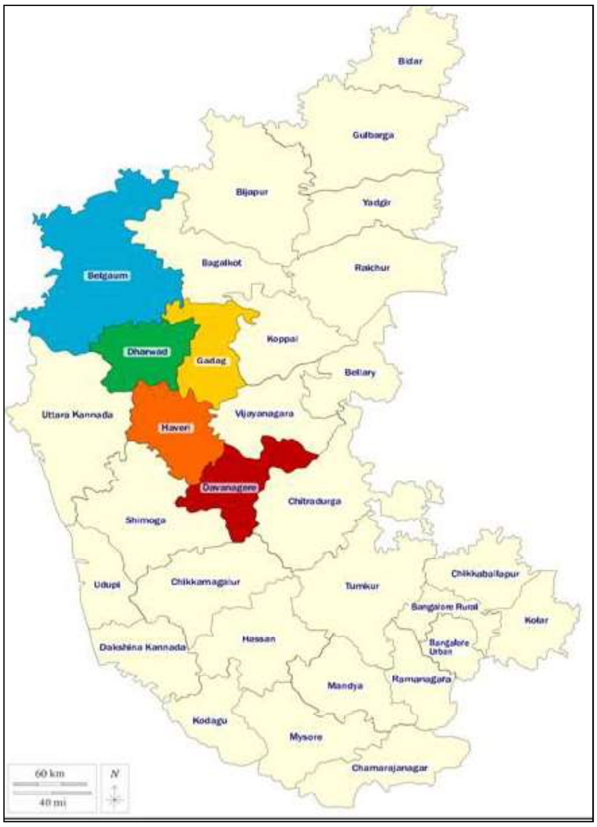


Fig 1. Survey for the incidence of Pokkah boeng disease of maize in northern Karnataka during *kharif, rabi* and Summer, 2024

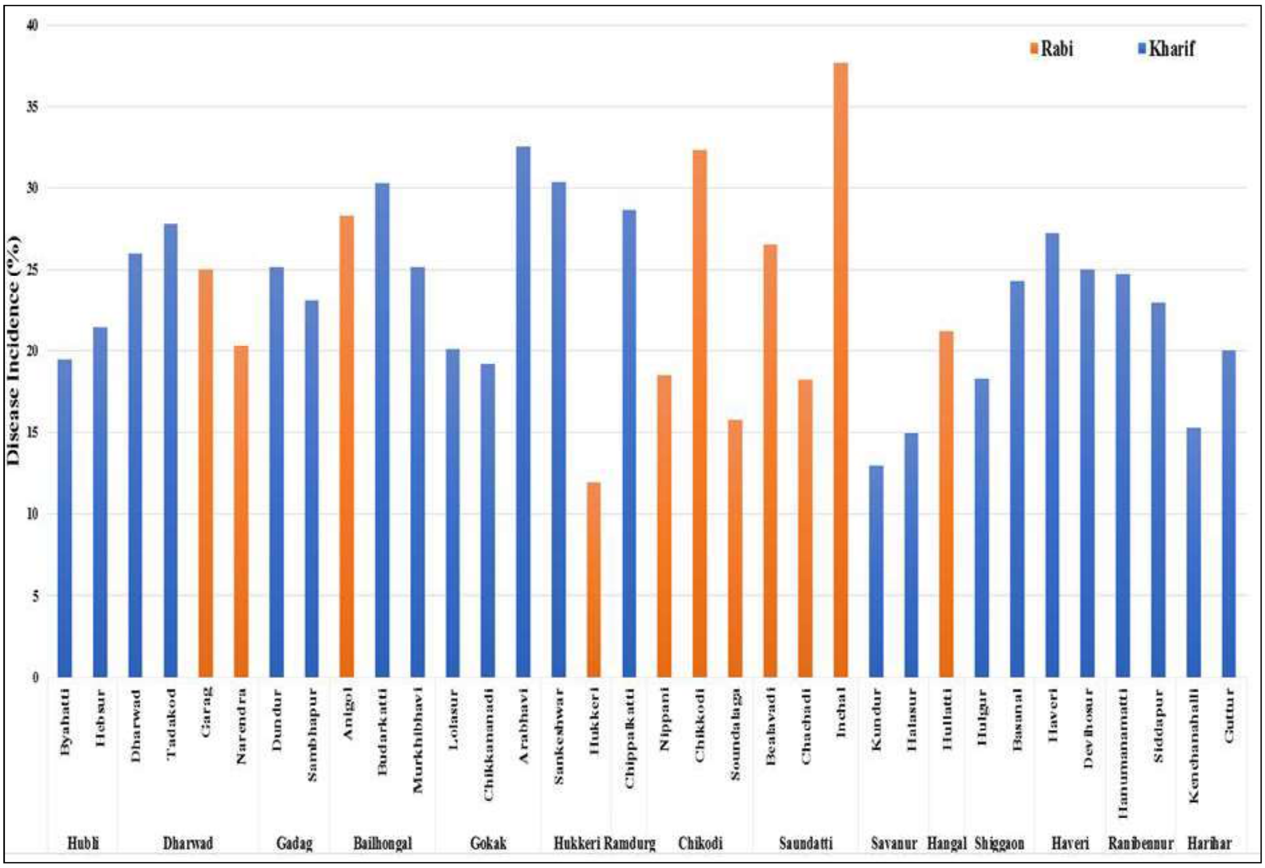


Fig 2. Incidence of Pokkah boeng disease of maize during *kharif,rabi* and Summer seasons, 2024

Table 1. Survey for Pokkah boeng disease incidence in the northern parts of Karnataka during 2024-25

District	Taluk	Village	Soil type	Rainfed/ Irrigated	Area (in acres)	Genotype/ Hybrid	Stage of the crop	Symptoms observed	Other diseases noted	Presence or absence of sugarcane/ sorghum	PB disease incidence (%)
Kharif											
Dharwad	Hubli	Byahatti	Red	Rainfed	1.5	PAC 751	Flowering	W	TLB	-	19.50
		Hebsur	Black	Rainfed	1	ADV 9293	Flowering	W	TLB, CLS	-	21.50
										Mean	20.50
	Dharwad	Dharwad	Black	Irrigated	2	DKC 9141	Physiological Maturity	W, T, R	TLB, MLB, C.Rust, FSR	-	26.00
		Tadakod	Black	Irrigated	2	S6668	Milky stage	W, T, TR	TLB, CR,FSR	S	27.80
										Mean	26.90
Gadag	Gadag	Dundur	Black	Irrigated	2	Arjun	Vegetative stage	W	TLB	-	25.20
		Sambhapur	Black	Irrigated	2.5	DKC 9133	Flowering	W	TLB, CLS	-	23.10
										Mean	24.15
Belagavi	Bailhongal	Budarkatti	Black	Irrigated	2	Arjun	Vegetative stage	W	-	S, Sc	30.30
		Murkhibhavi	Black	Irrigated	4	900 M Gold	Milky stage	W, R	TLB, C.rust	-	25.20
										Mean	27.75
	Gokak	Lolasur	Black	Rainfed	1	ADV 9293	Flowering	W	TLB	-	20.12
		Chikkananadi	Red	Rainfed	3	ADV 9293	Flowering	W	TLB	-	19.20
		Arabhavi	Black	Irrigated	5	DKC 9126	Vegetative stage	W, T, R	TLB, CR	S	32.56
										Mean	23.96
	Hukkeri	Sankeshwar	Black	Irrigated	1.5	P 3501	Vegetative stage	W	FSR	Sc	30.39
										Mean	30.39
	Ramdurg	Chippalkatti	Black	Irrigated	3	NK 6110	Vegetative stage	W	-	-	28.67
										Mean	28.67
Haveri	Savanur	Kundur	Red	Irrigated	1.5	NK 6240	Maturity stage	W	TLB	-	13.00
		Halasur	Red	Rainfed	5	P 3302	Vegetative stage	W	CLS	-	15.00
										Mean	14.00
	Shiggaon	Hulgur	Red	Rainfed	2	Target	Maturity stage	W	TLB	-	18.30
		Basanal	Black	Irrigated	1.5	NK 6240	Maturity stage	W	TLB	-	24.26
										Mean	21.28
	Haveri	Haveri	Black	Irrigated	1.5	NK 6110	Vegetative stage	C, W	-	-	27.23
		Devihosur	Black	Irrigated	3.5	S6668	Vegetative stage	W, T	TLB, C.rust, CLS	-	25.00
										Mean	26.12
	Ranebennur	Hanumanamatti	Black	Irrigated	2	DKC 9133	Vegetative stage	W, T, R	CR	-	24.75
		Siddapur	Black	Irrigated	1	DKC 9133	Vegetative stage	W	TLB	-	23.00
										Mean	23.88
Davangere	Harihar	Kenchanahalli	Red	Irrigated	1	NK 6110	Vegetative	T, SG	-	-	15.33
		Guttur	Red	Irrigated	1.5	DKC 9133	Vegetative stage	W, C	TLB	-	20.02
										Mean	17.68
Rabi											
Dharwad	Dharwad	Garag	Black	Irrigated	3	P3501	Vegetative stage	T, R	TLB, CLS	-	24.15
		Narendra	Black	Rainfed	5	DKC 9141	Grain filling	W, R	TLB, CLS	S	20.34
										Mean	22.25

cont….

Belagavi	Bailhongal	Anigol	Black	Irrigated	3	Target	Flowering	W	C.rust, TLB, CLS	S	28.32
										Mean	28.32
	Hukkeri	Hukkeri	Red	Rainfed	2.5	PAC 759	Silking stage	W	TLB, C.rust	-	11.99
										Mean	11.99
	Chikkodi	Nippani	Black	Irrigated	2	P3501	Vegetative	T, R, TR	-	-	17.56
		Chikkodi	Black	Irrigated	1	Target	Vegetative	W	-	S	32.36
		Soundalaga	Black	Irrigated	1.5	DKC 9141	Vegetative	W, T	TLB	-	15.77
										Mean	21.90
	Saundatti	Belavadi	Black	Irrigated	5	P 3302	Vegetative	T, R	FSR	Sc	26.54
		Chachadi	Black	Irrigated	4	PAC 751	Milky stage	T, R	-	-	18.23
		Inchal	Black	Irrigated	6.25	DKC 9126	Vegetative	R	-	Sc, S	37.67
										Mean	27.48
Haveri	Hangal	Hullatti	Red	Irrigated	1	ADV 9293	Vegetative	R	-	-	18.20
										Mean	18.20

W= Wrinkling of leaves, T= Twisting of leaves, R= Rolling of leaves, TR= Top rot, SG= Stunted growth, TLB= Turcicum leaf blight, CLS= Curvularia leaf spot, MLB= Maydis leaf blight, C.rust= Common rust, FSR= *Fusarium* stalk rot, CR= Charcoal rot, S= Sorghum, Sc= Sugarcane

were observed, often progressing to top rot at later stages. Other foliar diseases frequently recorded in association included Turcicum Leaf Blight (TLB), Curvularia Leaf Spot (CLS), Common Rust and Maydis Leaf Blight (MLB). Stalk rots such as Charcoal Rot (CR) and Fusarium Stalk Rot (FSR) were also present, indicating overlapping infection pressure from multiple *Fusarium* species.

Disease incidence was generally higher during the *kharif* season (23.28%) compared to the *rabi* season (22.83%) (Table 2). This seasonal difference likely resulted from higher humidity and rainfall during *kharif*, which favour disease development and pathogen spread. Similar trends have been reported by Supriya (2024), who observed increased Pokkah boeng severity in the rainy season across Karnataka.

Soil type also appeared to influence disease occurrence. Black soils, predominant in Belagavi, Haveri and parts of Dharwad, recorded a higher mean disease incidence (25.44%)

Table 2. Mean per cent disease incidence of Pokkah boeng disease of maize caused by *Fusarium* spp.

Particulars	Mean Per cent disease incidence
I. Season	
Kharif	23.28
Rabi	22.83
II. Genotype	
900 M Gold	25.20
ADV 9293	19.63
Arjun	27.75
DKC 9126	35.12
DKC 9133	22.72
DKC 9141	20.70
NK 6110	23.74
NK 6240	18.63
P 3302	20.77
P 3501	24.03
PAC 751	18.87
PAC 759	11.99
S 6668	26.40
Target	26.33
III. Soil type	
Black soil	25.44
Red soil	16.72
IV. Presence or absence of sorghum/ sugarcane	
Sorghum	28.28
Sugarcane	28.47
Both	33.99
Absent	20.81
V. Irrigated/Rainfed	
Irrigated	24.70
Rainfed	18.24
VI. Stage of the crop	
Vegetative	24.72
Flowering	21.96
Milky stage	23.74
Silking stage	11.99
Grain filling	20.34
Physiological maturity stage	20.39

Development of small streaks on leaves

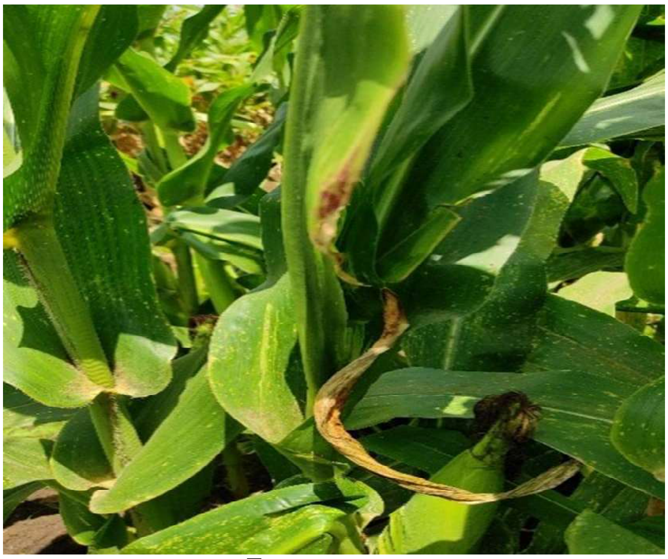
Chlorosis of leaf

Wrinkling of leaves

Twisting of leaf

Rolling of the leaf

Stunted growth of the plant



Top rot symptom

compared to red soils (16.72%). The higher moisture retention capacity of black soils likely created favourable microclimatic conditions for *Fusarium* growth and survival. In contrast, red soils with better drainage tended to suppress disease development. Irrigation practices also influenced disease expression. Fields under irrigated conditions showed a higher incidence (24.70%) than rainfed fields (18.24%), possibly due to transient waterlogging that promotes *Fusarium* infection. The observation aligns with findings in sugarcane by Manjula *et al*. (2023), who reported enhanced Pokkah boeng severity in moist environments.

Among crop growth stages, the vegetative stage showed the highest mean incidence (24.72%), while disease intensity generally declined in later stages, possibly due to tissue maturation and reduced pathogen colonization efficiency. Varietal differences were also evident. The genotype DKC 9126 showed the highest disease incidence (35.12%), indicating its susceptibility to *Fusarium*-associated Pokkah boeng. This is consistent with earlier observations by Supriya (2024), who reported that hybrids belonging to the DKC series were particularly prone to this disease. Other commonly affected genotypes included PAC 751, ADV 9293 and P 3501.

The survey highlighted a clear association between disease prevalence and cropping patterns. Fields intercropped with sorghum and sugarcane or located near their cultivation zones recorded higher incidence levels (33.99%) compared to those with single or alternate crops (28-29%). Villages such as Tadakod, Budarkatti, Arabhavi and Inchal, where sugarcane and sorghum were cultivated alongside maize, consistently exhibited elevated disease intensity. These findings support the hypothesis that sorghum and sugarcane act as collateral hosts, harbouring *Fusarium* inoculum that can persist between cropping seasons and infect subsequent maize crops.

District-wise analysis indicated that Belagavi and Gadag recorded higher mean incidence than other districts, likely due to higher humidity, more extensive maize cultivation, and the presence of alternative host crops. In contrast, Davangere recorded a comparatively low incidence (17.68%), possibly due to better-drained red soils and less favourable conditions for *Fusarium* proliferation.

Isolation and identification of the causal organism from infected samples confirmed the presence of different *Fusarium* spp., based on both morphological and molecular characteristics. These results corroborate earlier findings by Parime *et al*. (2021) and Harlapur *et al*. (2023), who reported similar pathogen profiles in Pokkah boeng-affected maize.The disease incidence patterns observed in the present study are comparable with reports from other maize-growing regions of Karnataka. Supriya (2024) recorded the highest incidence (29.32%) in Dharwad during 2023–24, while Bagalkot reported lower incidence (22.34%).

Conclusion

The study revealed that Pokkah boeng disease is widely prevalent in the maize-growing regions of northern Karnataka, with notable variation across districts and management practices. Disease incidence was influenced by climatic factors, soil type, cropping system and varietal susceptibility. Higher incidence was associated with black soils, humid environments, irrigation, and intercropping with sorghum or sugarcane. The findings emphasize the need for integrated management strategies, including the selection of resistant hybrids, improved field drainage and crop rotation to minimize pathogen carryover through collateral hosts.

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