Prevalence of rice sheath blight disease in Cauvery command area of Karnataka

ABSTRACT

Among the various disease of rice, sheath blight caused by *Rhizoctonia solani* Kuhn has become one of the major fungal diseases covering different rice growing ecosystem of Cauvery command area of Karnataka. Roving disease survey was conducted during Kharif-2022 to know the occurrence and spread of sheath blight disease in Cauvery command area of Karnataka i.e. Mandya, Hassan, Mysuru and Chamarajnagara. Among the four districts surveyed, disease severity (%) was found highest in Hassan district with a mean disease severity of 22.86% which is followed by Mandya (19.90%), Mysuru (19.39%) and least disease severity was recorded in Chamarajnagara (12.54%). The high severity of sheath blight might be due to the highly favourable factors like high relative humidity, less temperature and water stagnation in these locations during the period of survey. Large scale cultivation of susceptible varieties as mono crop continuously on the same field might have increased the possibility of perpetuating the pathogen in the crop debris. This study can serve as basic to evaluate location specific integrated disease management strategy against sheath blight disease of rice.

Keywords: Rice, Sheath blight, Disease severity, Cauvery

INTRODUCTION

Rice (*Oryza sativa* L.) is the world's second most economically important cereal crop after wheat in terms of total area and production and is a staple food for more than 60 per cent of world population (Verma and Shukla, 2011). "Rice is Life" for millions of people and staple food for more than half of the world's population. (Annegowda*et al*., 2021). Around 519.5 million metric tons of rice are produced worldwide on 165.25 million hectares (FAO, 2022). India is the second leading producer of the rice in the world with an area, production and productivity of 45.7 m ha, 124.37million tonnes and 2717 kg ha^{-1}, respectively (Anon., 2021). Rice production across the southern state of Karnataka in India amounted to about 3.08 million metric tonnes (2020). The state has about 27 growing districts, out of which 14 districts under high productivity group (yield more than 2500 kg/ha) and Tungabhadra command area consisting around 2.97 lakh hectare of land in Koppala, Bellary and Raichur districts, is popularly known as the "rice bowl of Karnataka" (Anon., 2020). Among biotic stresses, rice sheath blight is known as the second most economically important disease after blast of rice (Lee and Rush, 1983). Rice sheath blight caused by *Rhizoctonia solani*Kuhn (Teleomorph: *Thanatephoruscucumeris* (Frank) Donk) is a major fungal disease of rice causing yield losses to the extent of 1.2 to 69.0 per cent depending upon the environmental conditions, cultivar used and crop stage (Naidu,1992). *Rhizoctonia solani* is a soil borne, necrotrophic, basidiomycetous fungus mainly perpetuating on rice seeds, plant debris and in soil in the form of sclerotia and mycelia which serve as the primary inoculum (Mughal *et al*., 2017). The sclerotia can survive in the soil for more than 2 years and spread in the field during ploughing and flood irrigation thereby causing infection near the water level which spreads rapidly to the upper parts by runner hyphae. The disease is distinguished by the formation of

Comment [DN1]: the literature used is very old. Authors are suggested to review recent literature.

Comment [DN2]: Authors?

Comment [DN3]: Most of the literature used is very old. Authors are suggested to review recent literature published in last five years to present the clear picture of problem and other facts and figures

water soaked, greenish grey lesions (3-4 cm long and 1 cm wide) with irregular brown margins on the sheaths (Lee and Rush 1983).

In India, the estimation of losses due to this disease has been reported up to 54.3 % (Chahal et al., 2003). In Karnataka maximum severity of sheath blight was recorded at Gangavathi (37.79%) of Koppal district (Prasad *et al*. 2011). In this context survey is preliminary step to manage the sheath blight disease of rice. In view of the devastating nature of pathogen the roving survey was conducted in Cauvery command area of the Karnataka to know the status of the disease.

Comment [DN4]: Give the different objectives of the study

MATERIALS AND METHODS

Comment [DN5]: review this part

An intensive roving survey was conducted during *kharif* 2022 to assess the disease severity in major rice growing districts of Cauvery command area of Karnataka, *viz.*, Mandya, Mysuru, Chamarajanagar and Hassan (Fig. 1). The severity of sheath blight of rice was assessed based on the external symptoms using the SES scale IRRI, 2013 (Table 1).

Comment [DN6]: In the presentation of the study area, climatic factors such as cultivation practices, humidity, temperatures and rainfall, which can influence the spread of the disease, are missing.

Disease ratings were recorded as per the 0-9 SES scale of IRRI (2013). In each randomly selected plot (1 m^2 area), about 10 hills were selected randomly. In each hill, the disease was graded 0-9 based on vertical spread of the lesion. Using the grades, PDI was calculated following the formula given by (Wheeler, 1969).

Comment [DN7]: in the main rice-growing districts, the number of plots retained by the survey was not defined, i.e. the number of farmers surveyed

$$PDI = \frac{\text{Sum of the individual rating}}{\text{No. of plants examined} \times \text{Maximum disease scale}} \times 100$$

The data recorded during survey on District, Taluk, Location, variety, Stage of crop, Ecosystem, PDI, Taluk mean disease severity and District mean disease severity.

Table 1: Standard evaluation system as per IRRI (2013)for sheath blight of rice

Scale	Symptoms
0	No infection
1	Vertical spread of the lesions up to 20% of plant height
3	Vertical spread of the lesions up to 21- 30% of plant height
5	Vertical spread of the lesion up to 31 - 45% of plant height
7	Vertical spread of the lesion up to 46 – 65% of plant height
9	Vertical spread of the lesions up to 66-100% of plant height

Comment [DN8]: Where is the data analysis part. What software was used .

RESULTS AND DISCUSSION

Comment [DN9]: It's not just a question of comparing your results with previous studies, but rather of explaining them.
Review this section and insert sub-points.

The survey data revealed that the Hassan district had the highest mean sheath blight severity (22.86%) due to use of susceptible varieties and high temperature, followed by Mandya (19.90%), Mysuru (19.39%) and Chamarajanagara had the lowest mean disease severity of 12.54 per cent due to use of resistant varieties like super BPT (Table. 2 and Fig. 3).

In Mandya district, the disease incidence was documented in seven taluks, out of which, highest mean sheath blight severity was recorded in Pandavapura taluk (24.37%) due to high relative humidity of crop canopyfollowed by Srirangapatna (22.84%), Malavalli (20.63%), Nagamangala (19.02%) and Maddur (18.35%). The least incidence was recorded inKrishnarajpet andMandya taluks of 17.60 and18.26per cent respectively due to unsupportive epidemiological factors.

Seven taluks in the Hassan district were surveyed, of which, the highest mean disease severity was recorded in Sakleshpur taluk (30.52%) followed by Alur (28.10%), Belur (23.06%), Hassan (21.85%) and Holenarsipura (21.65%). The least severity was recorded in Channarayapatna and Arkalgud taluks of 15.37 and 19.50 per cent respectively (Table. 2 and Fig. 2).

Comment [DN10]: On what basis do you make these comparisons, given that you haven't put the probabilities to show whether it's significant or not?

Similarly, in seven taluks of Mysuru district, highest mean disease severity was noticed in T. Narsipura taluk (24.26%) followed by Mysuru (23.71%), Nanjangud (22.93%), H. D. Kote (18.90%) and K. R. Nagara (16.87%). The least mean disease severity was noticed in Periyapatna and Hunsur taluks of 13.39 and 15.73 Per cent respesctively. In Chamarajnagara district, Kollegala and Yellandur taluks were surveyed and recorded the mean disease severity of 12.89 and 12.47 per cent respectively. Among varieties, the highest PDI was observed in Tunga (35.25 %) in Sakleshpur taluk followed by Local variety (33.97 %) in Mysore taluk and Crossington (27.87 %) in Belur taluk. Whereas, minimum PDI was recorded in Super BPT (10.21 %) in Yellandur taluk (Table 2).

The present study was in accordance with Shivakumar (2014), who observed that, the prevalence of rice sheath blight ranged from 2.23 to 49.27% in the surveyed locations for different varieties, with the highest mean disease incidence occurring in Yadgir district (49.27%).

Table 2. District wise mean per cent disease index of sheath blight disease of rice in Karnataka during *kharif* 2022

Sl. no.	Districts	Taluks	PDI*	PDI**	Cultivars
1.	Mandya	Mandya	18.26	19.90	MSN 99, MTU 1001, Meenakshi, IR 64, Kaveri price, BNR,Chethana, Jaya, 1001, Kaveri, Siri, BR 2655, BPT 5204
		Pandavapura	24.37		
		Maddur	18.35		
		Malavalli	20.63		
		krishnarajpet	17.60		
		Srirangpatna	22.84		
		Nagamangla	19.02		
2.	Hassan	Channarayapatna	15.37	22.86	Thanu, Sona, Crossington, Jyothi, Vnr+ gold, Vnr+, Tunga, Sanna madhu, Penna, MTU 1001
		Hassan	21.85		
		Belur	23.06		
		Holenarsipura	21.65		
		Sakleshpur	30.52		
		Arkalgud	19.50		
		Alur	28.10		
3.	Mysuru	Mysore	23.71	19.39	IR 64, Bangla,

		H.D Kote	18.90		Jaya, Aman, Hybrid, Mogha, MTU 1001, Mahendra, Jyothi
		K.R Nagara	16.87		
		Hunsur	15.73		
		T. Narsipura	24.26		
		Periyapatna	13.39		
		Nanjangud	22.93		
4.	Chamrajnagara	Kollegala	12.89	12.54	KMP 175, Super BPT, BPT 5204, IR 64
		Yellandur	12.47		
		Chamrajanagar	12.27		

(= Mean PDI from all the villages, **= Mean PDI of all taluks)*

However, Chamarajnagar (2.23%) had the lowest mean sheath blight incidence. Prasad *et al*. (2011) observed that, the maximum incidence of sheath blight was recorded at Gangavathi (37.79%) of Koppal district, followed by Sindhanur (34.92%) of Raichur district and Siruguppa (31.14%) of Bellary district. The minimum incidence was recorded in Manvi (23.74%) of Raichur district. In Cauvery command area of Karnataka, two ecosystems are observed (Channel and Borewell). Among this, the highest PDI was recorded in channel ecosystem (21.85) and the least PDI was recorded in borewell ecosystem (14.35) (Table. 2).

Table 3. Rice-ecosystem wise mean percent disease index of sheath blight disease during kharif 2022

Sl. No.	Ecosystem	Taluks	PDI
1.	Channel	Mandya, Pandavapura, Maddur, Malavalli, Srirangpatna, Hassan, Belur, Holenarsipura, Sakleshpur, Alur, Mysore, H.D Kote, K.R Nagara, Hunsur, Nanjangud.	21.85
2.	Borewell	Krishnarajpet,Nagamangla,Channarayapatna, Arkalgud,T.Narsipura,Periyapatna,Kollegala, Yellandur,Chamrajanagar.	14.35

(= Mean PDI of all the taluks under the respective rice ecosystem)*

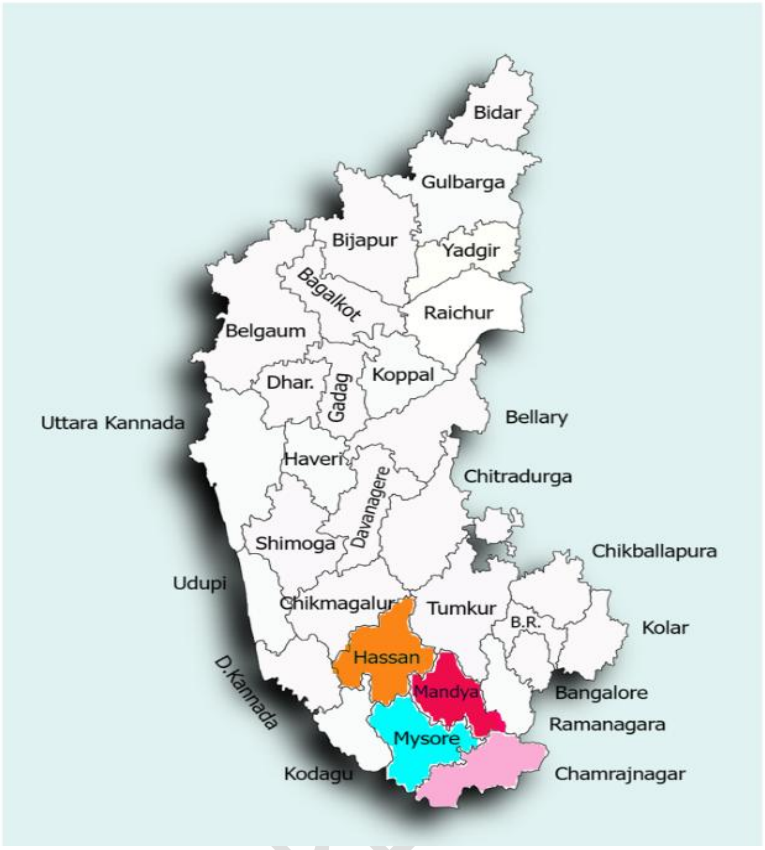

Fig.1. Karnataka map representing districts surveyed for occurrence of sheath blight in rice.

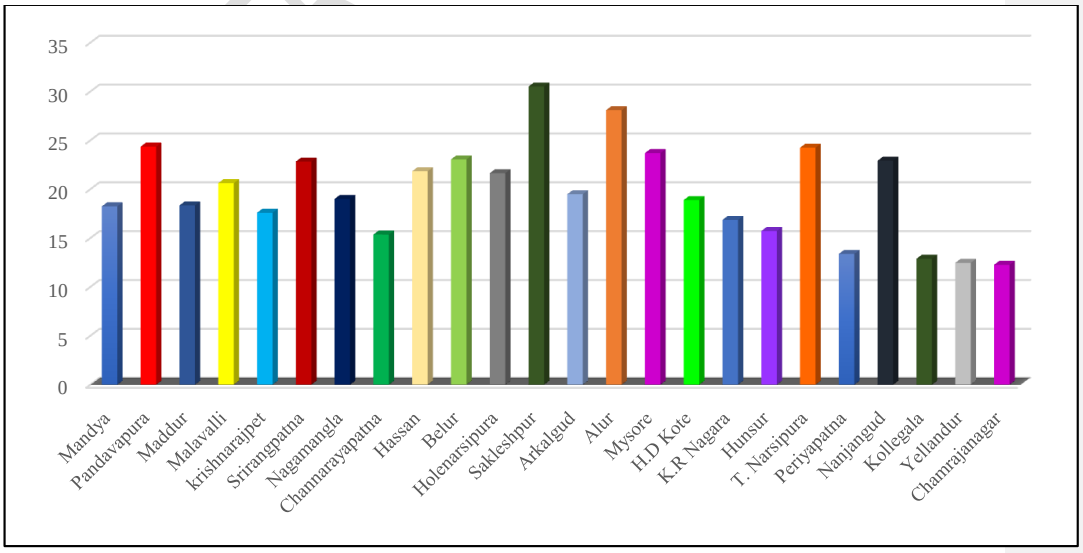

Fig. 2: Disease severity of sheath blight of rice in different surveyed taluks during *kharif* 2022.

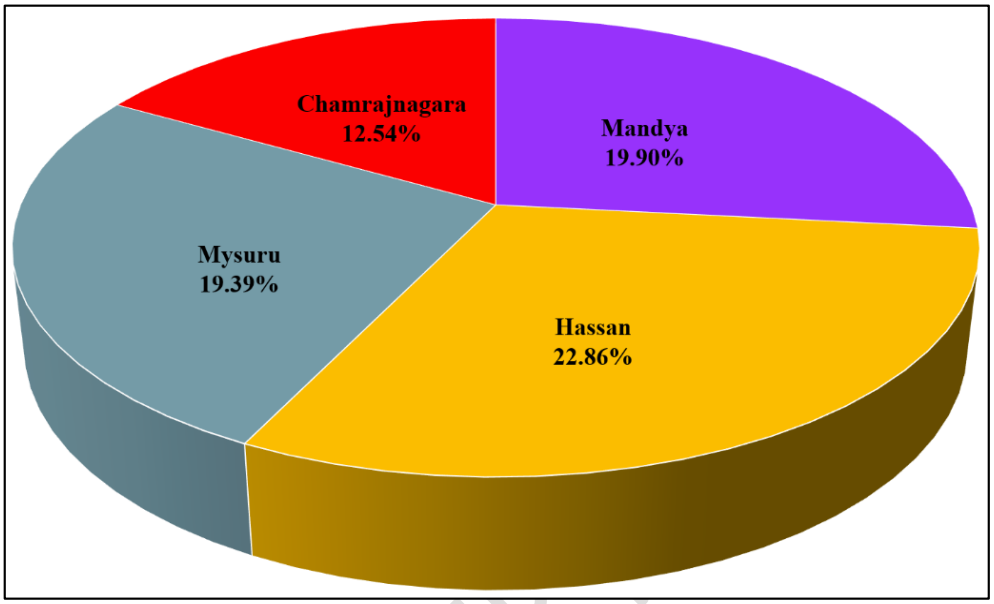

Fig. 3. District-wise mean PDI of sheath blight of rice during *kharif* 2022.

The sheath blight severity was higher under channel irrigation than in Borewell ecosystem, as shown in table 3, which is consistent with findings from Prasad *et al*. (2011) and Shivakumar (2014) who noted sheath blight in rice as a problem in regions with heavy rainfall and irrigated condition.

Our present study identified the prime sheath blight locations of Cavery command area of Karnataka. Being a dynamic pathogen, it can be effectively managed by the cultivation of resistant cultivars, sanitation of the field, rouging off the volunteer plants, collateral hosts in the fields.

CONCLUSION

Comment [DN11]: Provide a brief synthesis of the key findings in the conclusion, reinforcing the main outcomes and their collective significance for rice improvement programs.

Survey on occurrence and spread of sheath blight of rice revealed that disease was a major problem in Cauvery command area of Karnataka. Among the four districts surveyed Hassan district recorded highest mean of incidence 22.86% and Chamarajnagar district recorded least mean incidence of 12.54%. The heavy incidence of sheath blight might be due to the highly favourable factors like high relative humidity, less temperature and water stagnation in these locations during the period of survey. Large scale cultivation of susceptible varieties as mono crop continuously on the same field might have increased the possibility of perpetuating the pathogen in the crop debris. The present study may serve as a precursor for evolving management strategies against the disease effective for the zone in an integrated way for sustainable development of crop in the state.

REFERENCES

1. ANNEGOWDA DC, PRASANNAKUMAR MK, MAHESH HB, SIDDABASAPPA CB, DEVANNA P, BANAKAR SN, MANOJKUMAR HB, PRASAD SR. Rice blast disease in india: present status and future challenges. Integrative Advances in Rice Research; 2021.
2. ANONYMOUS. Karnataka's rice bowl at crisis as water level in TB dam sinks. THE HINDU; 2020.
3. ANONYMOUS. Indian economy of rice in the world. THE HINDU; 2021.
4. CHAHAL KS, SOKHI SS, RATTAN GS. Investigations on sheath blight of rice in Punjab. Indian Phytopathology; 2003.
5. Food and Agriculture Organization (FAO).www.fao.org.in; 2022.
6. LEE FN, RUSH MC. Rice sheath blight: A major rice disease. Plant Disease; 1983.
7. MUGHAL MN, AHMED M, BASHIR S, ANWAR A, BHAT KA, DAR ZA, BHAT MA, NISSA S, WANI RA, HAKEEM SA. 2017, Perpetuation of rice sheath blight pathogen (*Thanatephoruscucumeris*) under temperate conditions of Kashmir, India. International Journal of Current Microbiology and Applied Sciences; 2017.
8. NAIDU VD. Influence of sheath blight of rice on grain and straw yield in some popular local varieties. Journal Research, Assam Agriculture University; 1992.
9. PRASAD N, KUMAR MR. Comparative efficacy of different isolates of *Trichoderma spp*. against *Rhizoctonia solani*, Incitent of sheath blight of rice. Indian Journal of Fundamental and Applied Life Sciences; 2011.
10. SHIVAKUMAR, Investigations on major diseases of rice with special emphasis on rain discoloration. Ph. D. (Ag.) Thesis. Dept. of Plant Pathology,University of agricultural sciences; 2014.
11. VERMA DK, SHUKLA K. Nutritional value of rice and their importance. Indian Farmer's Digest, 2011.
12. WHEELER BEJ. An Introduction to Plant Diseases, John Wiley and Sons Limited, London, 1969.