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Locating of Hot Spots of Foot Rot (*Sclerotium rolfsii sacc.*) of Finger Millet in the Irrigated Ecosystem of southern Dry Zone of Karnataka

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ABSTRACT: Finger millet (*Eleusine coracana* (L.) Gaertn) is one of the important millet crops widely cultivated across India and more than 60 per cent of its area is concentrated in Karnataka. Even though it is hardy in nature, it has been affected from many biotic and abiotic stresses. Among them, foot rot caused by *Sclerotium rolfsii* is becoming a major threat in recent years to the finger millet production under irrigated and high rainfall condition. A different stage of crop is more susceptible to disease over a period of time and it gives them intensity with which it affects the yield. To know the occurrence and distribution of the pathogen a roving survey was carried out during *Kharif* 2019-20 in the major finger millet growing regions of Southern districts of Karnataka. The survey data showed that, mean foot rot disease incidence varied from 4.34 to 42.14 per cent in different locations. The highest mean per cent disease incidence was recorded in the Mandya district (42.14%), followed by Chamarajanagara (25.32%). while lowest disease incidence was recorded in the Tumakuru district (4.34%). It indicated that V. C. Farm (63.66%) and Mahadeshwarapura (57.20%) of Mandya district were the hotspots of pathogen. Among the different locations, canal irrigation with alternative wet and drying condition was most suitable for pathogen survival and establishment compare to borewell and low rain fall irrigation ecosystem. To identify the intensity and occurrence of pathogens in Finger Millet crop and also to locate the hotspot of disease a roving survey is most useful method.

Keywords: Finger millet, *Sclerotium rolfsii*, foot rot, Hotspot, Incidence.

INTRODUCTION

Finger millet (*Eleusine coracana* (L.) Gaertn) is a herbaceous, annual millet grown across India and Africa. Which is commonly referred as the "nutri-millet" and "poor man's food". Even though it is hardy in nature, it has been affected from many biotic and abiotic stresses. Among them the illnesses caused by fungi are the most prominent in recent years because of the continuous monoculture, cultural practices and use of high yielding varieties by farmers in the irrigated ecosystem has led to outbreak of soil borne diseases like foot rot caused by *Sclerotium rolfsii.* Foot root causes severe crop loss up to 50% (Batsa and Tamang, 1983) and is becoming a major threat to the finger millet production. Though the sclerotium in finger millet is minor and sporadic even the lesser incidence will cause huge economic loss and even though, it was reported in 1920 by Coleman from princely state of Mysore, there is no such extensive systematic work carried out on various aspects of foot rot of finger millet. According to Nagaraja and Reddy (2009) Foot rot was most frequently occurring disease especially in irrigated and heavy rainfall area. *S. rolfsii* causing foot rot disease is a soil inhabitant, polyphagus and a facultative parasite. A loss up to 50 per cent was recorded in Rampur, Nepal (Batsa and Tamang, 1983). Sujatha (1991) reported that disease incidence in Bengaluru ranged from 19-22 per cent. It occurs in diverse agro-climatic regions of tropical and subtropical continents and it is one of the most destructive soil inhabiting pathogens causing heavy loss to the crops both during Kharif as well as Rabi and summer seasons. However, it is essential to study the occurrence of foot rot of finger millet to know the present scenario about the incidence and the intensity with which it affects the yield in addition to the most susceptible stage of the crop to develop the location specific management practices. Hence, the intensive survey was carried to locate the hotspots to know severity and distribution of the disease.

MATERIAL AND METHODS

An intensive roving survey was carried out to know the occurrence of foot rot disease of finger millet during *Kharif* 2019-20, in different districts under southern dry zone of Karnataka to know the incidence and intensity of foot rot disease occurrence and incidence of*S. rolfsii.* The districts include Mandya, Mysuru, Chamarajanagara, parts of Hassan and Tumakuru. Minimum of four to five fields were chosen in a location and two to three plots of one square meter area were selected randomly in each field. The total number of plants present and number of plants showing symptoms due to infection of *S. rolfsii* in each selected plots were recorded and per cent disease incidence (PDI) was calculated. The details of places surveyed are presented in Table 1.
Following formula was used for calculating the PDI,

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Table 1: Details of locations selected for surveying foot rot in finger millet.

Sr. No.	District	Taluk	Locations
1.	Mysuru	H. D. Kote	Madapura, Saraguru, Kalegowdana Hundi, Nanjanayakanahalli
		Hunsuru	Doddegowdanakoppalu, KuppeKolagatta, Bilikere, Kattemalavadi
		K. R. Nagara	Kumbarakoppalu, Arakere, Hampapura, Doddekoppalu
2.	Mandya	Mandya	Beevukallu, V.C. Farm, Hadya, Beevukallu, Holalau, Shivalli, Hanakere,
		Pandavapura	Manikyanalli, Lakshmi sagara, Singarigowdanakoppalu, Mahadeshwarapura
		Srirangahapattana	Hosahalli, Tubinakere, Palahalli, Baburayanakoppalu,
		Malvally	Kandegala, Anchedoddi, Ragibommanahalli, Dugnalli
3.	Hassan	Channarayanapatna	Channarayapattana, Vaddarahalli, Dandiganahalli, Jattenahalli.
4.	Chamarajanagara	Chamarajanagara	Hadanahally, Bisalavadi, Kottalavadi,
		Gundlupete	Devarahally, Hangala, Baachalli, Gopalapura
		Kollegala	Sarguru, Harle, Agrahara, Mamballi.
5.	Tumakuru	Kunigal	Hebbur, Yediyur, Amrutur, Vaddarahatti

RESULTS AND DISCUSSION

An intensive roving survey was undertaken during *Kharif* 2019-2020 to assess the severity of foot rot of finger millet in major finger millet growing irrigated and rainfed areas of Southern districts of Karnataka*viz.*, Mandya, Mysuru, Chamarajanagara and parts of Hassan and Tumakuru to get precise information on the occurrence, distribution and severity of the *S. rolfsii* in finger millet (Table 2, Plate 1 and Fig. 1).

Table 2: Prevalence of foot rot in finger millet in different ecosystems of southern dry zone of Karnataka.

Sr. No.	District	Taluk	Locations	Stage of crop	Ecosystem	Per cent Foot rot incidence	Taluk Mean
1.	Mysuru	H. D. Kote	Madapura	Dough stage	Protective	32.71	**21.16**
2.			Saraguru	Tillering	Rainfed	10.31	
3.			Kalegowdana Hundi	Tillering	Rainfed	16.10	
4.			Nanjanayakanahalli	Tillering	Protective	25.53	
5.		Hunasuru	Doddegowdanakoppalu	Grain filling	Rainfed	18.34	**16.42**
6.			KuppeKolagatta	Dough stage	Rainfed	16.24	
7.			Bilikere	Grain filling	Rainfed	18.30	
8.			Kattemalavadi	Tillering	Protective	12.82	
9.		K. R. Nagara	Kumbarakoppalu	Grain filling	Protective	13.74	**24.54**
10.			Arakere	Tillering	Canal	15.60	
11.			Hampapura	Dough stage	Canal	45.78	
12.			Doddekoppalu	Grain filling	Canal	23.06	
						Mean	**20.71**
13.	Mandya	Mandya	V. C. Farm	Dough stage	Canal	63.66	**42.24**
14.			Hadya	Grain filling	Canal	54.77	
15.			Beevukallu	Tillering	Canal	51.22	
16.			Holalu	Dough stage	Canal	17.51	
17.			Shivalli	Grain filling	Canal	37.91	
18.			Hanakere	Tillering	Canal	28.40	
19.		Pandavapura	Manikyanalli	Grain filling	Canal	46.07	**52.25**
20.			Lakshmi sagara	Grain filling	Canal	50.02	
21.			Singarigowdanakoppalu	Dough stage	Canal	55.55	
22.			Mahadeshwarapura	Tillering	Protective	57.20	
23.		Srirangahapattana	Hosahalli	Tillering	Canal	48.55	**49.94**
24.			Tubinakere	Tillering	Canal	54.64	
25.			Palahalli	Tillering	Protective	42.44	
26.			Baburayanakoppalu	Grain filling	Canal	54.33	
27.			Arkere	Dough stage	Canal	49.74	
28.		Malavally	Kandegala	Grain filling	Protective	4.63	**22.17**
29.			Anchedoddi	Tillering	Canal	38.66	
30.			Ragibommanahalli	Tillering	Canal	19.06	
31.			Dugnalli	Tillering	Protective	26.35	
						Mean	**42.14**
32.	Hassan	Channarayanapatna	Channarayapattana	Grain filling	Protective	11.08	**9.96**
33.			Vaddarahalli	Tillering	Protective	0.00	
34.			Dandiganahalli	Tillering	Rainfed	14.15	
35.			Jattenahalli	Tillering	Protective	14.62	
						Mean	**9.96**
36.	Chamarajanagara	Chamarajanagara	Hadanahally	Grain filling	Protective	31.33	**22.03**

Sr. No.	District	Taluk	Locations	Stage of crop	Ecosystem	Per cent Foot rot incidence	Taluk Mean
37.			Bisalavadi	Dough stage	Rainfed	0.00	
38.			Kottalavadi	Grain filling	Protective	34.78	
39.		Gundlupete	Devarahally	Tillering	Protective	44.69	**30.87**
40.			Hangala	Tillering	Rainfed	43.77	
41.			Baachalli	Tillering	Rainfed	25.13	
42.			Gopalapura	Tillering	Rainfed	9.90	
43.		Kollegala	Sarguru	Grain filling	Rainfed	24.04	**22.24**
44.			Harle	Dough stage	Canal	20.87	
45.			Agrahara	Grain filling	Canal	24.42	
46.			Mamballi	Dough stage	Protective	19.66	
						Mean	**25.32**
47.	Tumakuru	Kunigal	Hebbur	Grain filling	Protective	3.27	**4.34**
48.			Yediyur	Grain filling	Protective	2.47	
49.			Amrutur	Dough stage	Protective	7.00	
50.			Vaddarahatti	Dough stage	Protective	4.63	
						Mean	**4.34**

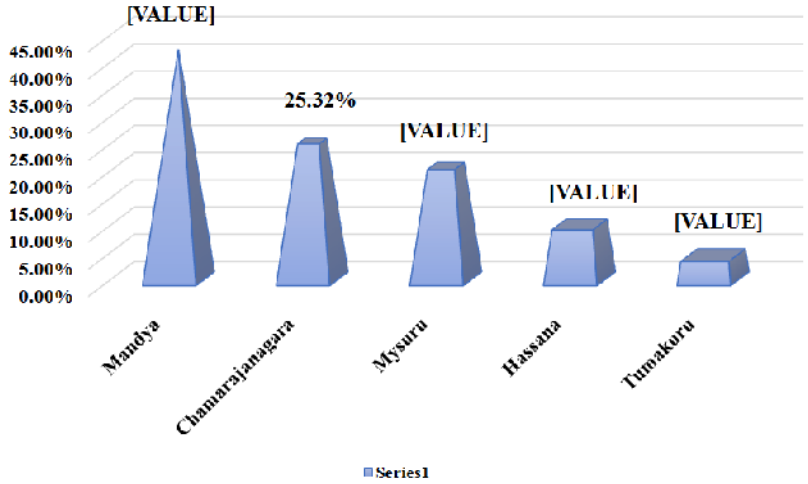

Fig. 1. Incidence of foot rot in Southern districts of Karnataka.

Plate1: Field view of survey for occurrence of foot rot disease in finger millet during *Kharif*-2019.

Incidence of foot rot on finger millet were reported by various workers from Coimbatore (Anon., 1954), Uttarakhand (Kumar and Prasad, 2010) and Gujarat (Waghunde *et al.*, 2011).The incidence of foot rot disease was observed in all the five districts surveyed. The maximum mean of foot rot disease incidence was observed in the Mandya district (42.14%) followed by Chamarajanagara (25.32%), Mysuru (20.71%) and Hassan districts (9.96 %). The minimum mean disease incidence was observed in the Tumakuru district (4.34%).

In Mysuru district three taluks were covered. Out of which, the highest mean foot rot incidence was recorded in K. R. Nagara taluk (24.54%) followed by H. D.Kote (21.16%) and Hunasuru taluks (16.42%). Among the villages, the Hampapura village of K. R. Nagara taluk recorded the highest incidence (45.78%) under alternative canal irrigation system followed by Nanjanayakanahalli (25.53%) of H. D. Kote taluk under the rainfall condition. The least incidence was recorded in Saraguru

village (10.31%) of H. D.Kote taluk under rainfed condition. Similarly, in four taluks of Mandya district, highest mean foot rot disease incidence in Pandavapura taluk (52.25%) followed by Srirangapattana (49.94 %). The least mean foot rot disease incidence was noticed in Malavalli taluk (22.17 %). Among the villages, the highest incidence was recorded in V. C. Farm (63.66 %) of Mandya taluk under alternative canal irrigation followed by Mahadeshwarapura (57.20 %) and SingarigowdanaKoppalu (55.55%) villages of Pandavapura taluk under alternative canal irrigation system. The lowest mean incidence was recorded in the Kandegala (4.63%) village of Malvallitaluk under protective irrigated condition.

In Hassan district, Channarayapattana taluk of zone 6 was surveyed and recorded the mean foot rot incidence of 9.96 %. Among the villages, Jatenahalli (14.62 %) recorded the highest incidence under protective irrigation followed by Dandiganahalli (14.15%) and Channarayapattana (11.08 %) under rainfed and protective irrigation respectively. There was no incidence of foot rot disease in the Vaddarahalli (0.00%) under protective irrigation. Similarly, in the Kunigal areas of Tumakuru district the mean per cent incidence of 4.34% was recorded and among the different villages, Amrutur village (7.00%) recorded the highest incidence under protected condition whereas the least was recorded in Yediyur (2.47 %) under similar conditions.Similar result is shown by Reddy *et al.*,(1971) in that he carried out survey during 1969-70 in Karnataka and found that, losses due to foot rot in wheat crop were about five per cent.

In the Chamarajanagara district, the highest mean per cent incidence was recorded at Gundlupet taluk (30.87%) followed by the Chamarajanagara and Kollegela taluks with 22.03 and 22.24 per cent, respectively. Among the villages, Devarahally village of Chamarajanagar taluk under protective irrigation recorded the highest incidence (44.69%) followed by Hangala village (43.77%) of Gundlupete taluk under the rainfed condition and no disease was recorded at Bisalavadi village (0.00%) of Chamarajanagar taluk under rainfed condition.

The mean foot rot incidence ranged from 4.34 to 42.14 per cent in different locations of Southern Karnataka. Based on the survey data collected from different districts, the diseased areas were classified as less incidence with a range of 0 to 5.00 per cent in Tumakuru district (4.34%), moderate incidence with a range of 5.1 to 15.00 per cent in Hassan district (9.96 %) and the high incidence with a range of >15.00 per cent as in Mandya (42.14%), Chamarajanagara (25.32%), and Mysuru districts (20.71%).Based on the survey result the locations were categorised into high (>15%), medium (5-15%) and low (<5%). The locations which recorded predominant was considered as hotspots of the pathogen. The varied disease incidence among locations may be attributed to the varied agro-climatic situations, rainfall pattern, cropping systems, varieties grown and cultural practices adopted by the farmers; and possibly due to existence of pathogenic variability. It is evident from the table 1that, the foot rot incidence was high under canal irrigation than under protective and rainfed conditions which is in consonance with findings of Nagaraja and Reddy (2009) and Raveendra (2018) who reported foot rot as a problem in heavy rainfall areas and irrigated ragi. The result of the present investigation revealed wide-ranging levels of foot rot incidence recorded in major finger millet growing areas of the rainfed and irrigated condition, thus is in conformity with the previous workers across the country *viz.,* Coimbatore (Anon., 1954), Uttarakhand (Kumar and Prasad, 2010), Gujarat (Waghunde *et al*., 2011) and Karnataka (Nagamma and Nagaraja, 2015).

SUMMARY

To identify the intensity and occurrence of pathogens in Finger Millet crop and also to locate the hotspot of disease a roving survey is most useful method. In this survey identify that highest per cent disease incidence was recorded in the regions of Mandya district (V. C. Farm (63.66%) and Mahadeshwarapura (57.20%))with canal irrigated condition, followed by regions of Chamarajanagara under protected irrigation was identified as the hotspots for foot rot of finger millet. Survey of the disease over a period of time gives the intensity with which it affects the yield in addition to the most susceptible stage of the crop. And also it helps to locate the hotspot of the disease in finger millet. The foot rot incidence was high under canal irrigation than under protective and raifed conditions.

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