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Survey on blast [*Pyricularia grisea* [(Cooke) Sacc.] disease of finger millet in major finger millet growing areas of Andhra Pradesh

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Abstract
Finger millet blast caused by *Pyricularia grisea* is a major yield limiting factor in finger millet growing areas of Andhra Pradesh. A roving survey was conducted to assess blast disease incidence in finger millet crop during *Kharif* 2020 in Andhra Pradesh. The highest PDI of finger millet blast was noticed in fields of Salur village (59.20%) of Salur Mandal in Vizianagaram district and the least disease incidence was recorded in Somidevipalle village (5.02%) of Racherla mandal of Prakasam district. It was concluded that, maximum incidence in Vizianagaram district might due to monocropping, prevalence of congenial micro climate and existence of initial inoculum.

Keywords: Blast disease, per cent disease incidence, disease survey, inoculum, finger millet

Introduction
Finger millet is a small-grained cereal grown in dry and semi-arid regions of East and South Africa, as well as Southern Asia (Jenkins *et al*, 1982; Dida *et al*, 2007; Upadhyaya *et al*, 2007; Waghunde *et al*, 2013; Jegan, 2015; Negi *et al*, 2015; Thilakarathna and Raizada, 2015; Kumar *et al*, 2016; Gupta *et al*, 2017) [6, 1, 19, 20, 5, 12, 18, 8, 4]. Its seed is rich source of protein, iron, calcium, phosphorus, glucose, zinc, and gluten-free amino acids such methionine, leusine, isoleusine, and phenylalamine. (Kumar *et al*, 2016) [8]. With all these benefits, finger millet is affected by many diseases such as root rot, smut, streak, mottling virus and blast disease. *E. coracana* is tolerant to most of these diseases however blast disease is the most devastating and destructive leading to losses in yield and poor utilization by farmers (Ramakrishnan *et al*, 2016) [14].

Finger millet blast disease, caused by *Pyricularia grisea* is the most economically important disease of finger millet (Mgonja *et al*, 2007) [10]. It is known to cause significant losses in yield and utilization of finger millet. Worldwide losses of above 50% yield have been reported in finger millet and above 30% in rice production (Esele, 2002; Prajapati *et al*, 2013) [2, 13]. In India, an increase in 1% infection in the neck and finger results to a corresponding increase of 0.32 and 0.084% in yield losses and grain losses of 6.75 to 87.5%, respectively (Rao, 1990) [15]. Effect on the panicle on susceptible genotypes is drastic and may lead to total seed loss of entire finger millet crop (Gashaw *et al*, 2014) [3]. Muimba-Kankolongo (2018) [11] reported that favorable weather conditions (temperature of 25 ºC and 80% humidity) precedes infection of blast diseases, which starts when a three celled conidia lands on a leaf surface. This leads to formation of an appressorium which later forms a penetration peg, punctures the cuticle allowing entry to the epidermis. Formation of lesions then follow which later spreads to the whole plant through the epidermis forming diamond shaped grey lesions with brown or black margins. Infection from the leaves begins from the tip backwards. The disease has a wide range of hosts especially grasses and sedge species including rice (*Oryza sativa*), wheat (*Triticum aestivum*), pearl millet and foxtail millet (*Setaria italica*). Blast affects production and utilization of these crops leading to a substantial decrease in production in Southern Asia, Eastern and Southern Africa (Takan *et al*, 2012) [17].

Material and Methods

Roving survey was conducted for the incidence of finger millet blast during *Kharif* 2020 in major finger millet growing districts of Andhra Pradesh *viz.*, Kadapa, Chittoor, Anantapuram, Kurnool, Prakasam, Guntur and Vizianagaram. Each district was divided into two mandals, in each mandal three villages are selected. In each village three fields were chosen for the study. Observations on soil type, farming situation, varieties and disease incidence were recorded in one square meter area randomly in each field.

The data was recorded based on occurence of blast in observed fields was expressed as Per cent Disease Incidence (PDI).

$$PDI = \frac{\text{Diseased hills observed}}{\text{Total No. of hills observed}} \times 100$$

Result and discussion

The detailed survey was undertaken in different regions of Andhra Pradesh to gather information on per cent disease incidence and spread of *Pyricularia grisea* causing blast disease of finger millet in different locations. This information is highly useful to identify the hot spots of this disease in Kadapa, Chittoor, Anantapuram, Kurnool, Prakasam, Guntur and Vizianagaram (Fig.1) where finger millet is extensively grown as a major crop. From the survey it was evident that the disease severity varied from one locality to another based on the soil type, farming situation and varieties used.

Among the seven districts surveyed, highest mean Per cent Disease Incidence (PDI) 56.31% was recorded in Vizianagaram district. It was followed in Chittoor, Kadapa and Kurnool, with mean Per cent Disease Incidence of 42.71, 22.27 and 20.45%, respectively. The lowest mean disease incidence 7.54% was recorded in Prakasam district followed by Anantapuram (19.37%) and Guntur (19.68%) districts (Table 1).

The highest mean blast incidence 56.63% was recorded in Salur mandal of Vizianagaram district in a range of 53.86-9.20% incidence which was followed by Kurupam mandal of Vizianagaram district with 55.99% mean PDI in a range of 54.63% to 57.56%. However, the mean PDI in Palamner mandal was 53.41% with range of 49.25 to 57.52%, Kuppam mandal (32.00% with range of 29.45 to 33.78%), Pattikonda mandal (27.92% with range of 24.32 to 33.23%), Veldurthi mandal (24.54% with range of 12.28 to 48.21%), Gudibanda mandal (23.31% with range of 17.78 to 28.96%), Vallur mandal (22.81% with range of 8.05 to 49.23%) and Kamalapuram mandal (21.73% with range of 15.03 to 30.13%) of Kadapa district. Peapully mandal (12.97% with 9.09 to 15.54%), Madakasira mandal (15.43% with 11.01 to 18.14%) and Macherla mandal (14.81% with 11.13 to 17.24%) of Guntur district. The lowest PDI of 7.30% with 5.02 to 9.01% was noticed in Racherla mandal which was followed by Komarolu mandal (8.04% with 5.85 to 9.21%) of Prakasam district (Table 2).

The highest PDI of finger millet blast was noticed in fields of Salur village (59.20%) of salur mandal, least was noticed in Kurmarajupeta (53.86%) in Vizianagaram district. In Chittoor district, maximum incidence of blast was noticed in Palamner village of Palamner mandal (57.52%) and least incidence was noticed in Palarlapalle (29.45%). In Kadapa district highest incidence of blast was observed in Lingayapalle village (49.23%) of Vallur mandal and least was observed in Goturu village (8.05%) of Vallur mandal. In Kurnool district, maximum incidence of blast was noticed in Chakrarala village (33.23%) of Pattikonda mandal and least was in Pothidoddi village (9.09%) of Peapully mandal. In Guntur district maximum disease incidence was noticed in Gundlapadu village (48.21%) of Veldurthi mandal and least disease incidence was recorded in Koppunur village (11.13%) of Macherla mandal. In Anantapuram district highest disease incidence was noticed in Gudibanda village (28.96%) of Gudibanda mandal and least disease incidence was recorded in Haresamudram village (11.01%) of Madakasira mandal. While, in Prakasam district maximum disease incidence was recorded in Komarolu village (9.21%) of Komarolu mandal and least was in Somidevipalle village (5.02%) of Racherla mandal (Table 3). The present results were in agreement with the findings of Rao (1990) [15] surveyed in eight locations of Bangalore, Kolar and Tumkur districts in Karnataka, and reported that an increase of 1% infection in neck and finger resulted in a corresponding increase of 0.32 and 0.084% yield loss and 6.75 to 87.5% loss in grain yield. Similarly, Kumar *et al.* (2005) [9] who reported the maximum neck (13-16%) and finger blast (42-55%) incidence in surveyed locations of Tumkur district of Karnataka. The same way Senthil *et al.* (2012) also reported that the finger millet blast was the most devastating disease affecting different aerial parts of the plant at all stages in Tamil Nadu (India). Prajapati (2013) [13] surveyed in different locations of Gujarat and reported the loss of 35.78 grain yield and 43.72 per cent fodder yield due to the blast disease. Kaurav *et al.* (2017) reported 1 to 5.48% and 3.60 to 13.80% severity of blast disease in major pearl millet growing districts of Madhya Pradesh during 2015-16 and 2016-17 respectively.

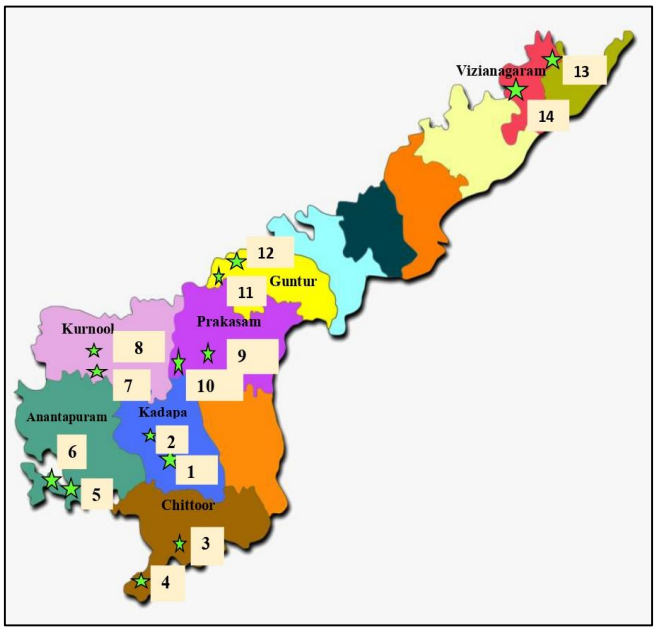

Fig 1: Map showing surveyed districts of Andhra Pradesh

Kadapa	**Chittoor**	**Anantapuram**	**Kurnool**
1. Vallur	3. Palamner	5. Madakasira	7. Peapully
2. Kamalapuram	4. Kuppam	6. Gudibanda	8. Pattikonda
Prakasam	**Guntur**	**Vizianagaram**	
9. Racherla	11. Veldurthi	13. Kurupam	
10. Komarolu	12. Macherla	14. Salur	

Table 1: Finger millet blast incidence in major finger millet growing districts of Andhra Pradesh

Sl. No	District	Range of PDI	District mean PDI
1	Kadapa	8.05-49.23	22.27
2	Chittoor	29.45-57.52	42.71
3	Anantapuram	11.01-28.96	19.37
4	Kurnool	9.09-33.23	20.45
5	Prakasam	5.02-9.21	7.54
6	Guntur	11.13-48.21	19.68
7	Vizianagaram	53.86-59.20	56.31

Table 2: Finger millet blast incidence in major finger millet growing mandals of Andhra Pradesh

Sl. No	Mandal	Range of PDI	Mandal mean PDI
	Kadapa		
1	Vallur	8.05-49.23	22.81
2	Kamalapuram	15.03-30.13	21.73
	Chitoor		
1	Palamner	49.25-57.52	53.41
2	Kuppam	29.45-33.78	32.00
	Anantapuram		
1	Madakasira	11.01-18.14	15.43
2	Gudibanda	17.78-28.96	23.31
	Kurnool		
1	Peapully	9.09-15.54	12.97
2	Pattikonda	24.32-33.23	27.92
	Prakasam		
1	Racherla	5.02-9.01	7.03
2	Komarolu	5.85-9.21	8.04
	Guntur		
1	Veldurthi	12.28-48.21	24.54
2	Macherla	11.13-17.24	14.81
	Vizianagaram		
1	Kurupam	54.63-57.56	55.99
2	Salur	53.86-9.20	56.63

Table 3: Survey for the occurrence and distribution of finger millet blast incidence in major finger millet growing areas of Andhra Pradesh

Sl. No	District	Mandals	Villages	Latitude	Longitude	Varieties	Soil type	Farming situation	Per cent disease incidence
									2020
1	Kadapa	Vallur	Lingayapalle	14º34'19"	78º44'41"	Local	Red loam	Rainfed	49.23
			vallur	14º19'59"	78º25'54"	Local	Red loam	Rainfed	11.15
			Goturu	14º33'36"	78º44'14"	Vakula	Red loam	Rainfed	8.05
		Kamalapuram	Kamalapuram	14º35'57"	78º39'51"	Tirumala	Red loam	Rainfed	30.13
			Ramachandrapuram	14º39'40"	78º38'29"	Local	Red loam	Rainfed	15.03
			T. sadipirala	14º35'08"	78º37'16"	Local	Red loam	Rainfed	20.02
2	Chittoor	Palamner	Palamner	13º11'51"	78º45'22"	Vakula	Red loam	Rainfed	57.52
			moram	13º10'21"	78º41'33"	Vakula	Red loam	Rainfed	53.46
			Kurmoi	13º09'57"	78º44'06"	Vakula	Red loam	Rainfed	49.25
		Kuppam	Gonugur	12º42'54"	78º19'48"	Vakula	Red loam	Rainfed	32.78
			Jarugu	12º73'55"	78º16'57"	Vakula	Red loam	Rainfed	33.78
			palarlapalle	12º42'55"	78º19'20"	Vakula	Red loam	Rainfed	29.45
3	Anantapuram	Madakasira	Govindapuram	13º88'28"	77º19'97"	Tirumala	Red loam	Rainfed	17.13
			Jadrahalli	13º53'34"	77º15'29	Vakula	Red loam	Rainfed	18.14
			Haresamudram	13º55'00"	77º16'03"	Vakula	Red loam	Rainfed	11.01
		Gudibanda	Morubagal	13º58'18"	77º02'12"	Vakula	Red loam	Rainfed	17.78
			Gudibanda	13º58'13"	77º06'30"	Local	Red loam	Rainfed	28.96
			Muthkur	13º58'08"	77º03'55"	Vakula	Red loam	Rainfed	23.19
4	Kurnool	Peapully	Peapully	15º14'25"	77º44'19"	Local	Red loam	Rainfed	14.28
			Vengalampalle	15º15'05"	77º46'06"	Local	Red loam	Rainfed	15.54
			Pothidoddi	15º12'19"	77º43'00"	Vakula	Red loam	Rainfed	9.09
		Pattikonda	Pattikonda	15º24'01"	77º30'25"	Vakula	Red loam	Rainfed	26.22
			Chakrarala	15º23'43"	77º34'40"	Vakula	Red loam	Rainfed	33.23
			Juturu	15º29'10"	77º28'24"	Local	Red loam	Rainfed	24.32
5	Prakasam	Racherla	Anumulapalle	15º29'09"	78º58'04"	Vakula	Red loam	Rainfed	7.07
			Racherla	15º27'54"	78º57'49"	Vakula	Red loam	Rainfed	9.01
			Somidevipalle	15º27'27"	79º02'02"	Vakula	Red loam	Rainfed	5.02
		Komarolu	Taticherla	15º2s3'04"	79º02'47"	Vakula	Red loam	Rainfed	9.05
			Chinthalapalli	15º16'41"	79º03'13"	Local	Red loam	Rainfed	5.85
			Komarolu	15º15'57"	78º59'50"	Vakula	Red loam	Rainfed	9.21
6	Guntur	Veldurthi	Veldurthi	16º20'47"	79º21'50"	Vakula	Red loam	Rainfed	13.14
			Uppalapadu	16º21'28"	79º24'05"	Local	Red loam	Rainfed	12.28
			Gundlapadu	16º21'50"	79º20'21"	Vakula	Red loam	Rainfed	48.21
		Macherla	Macherla	16º28'51"	79º25'46"	Vakula	Red loam	Rainfed	17.24
			Kothapalle	16º29'46"	78º24'30"	Vakula	Red loam	Rainfed	16.07
			Koppunur	16º29'22"	79º19'48"	Vakula	Red loam	Rainfed	11.13
7	Vizianagaram	Kurupam	Gumma	18º95'17"	83º64'33"	VR 847	Red loam	Rainfed	57.56
			Sivada	18º91'52"	83º74'25"	VR 847	Red loam	Rainfed	54.63
			Gummidiguda	18º83'65"	83º77'45"	VR 847	Red loam	Rainfed	55.78
		Salur	Neliparthi	18º50'21"	83º18'45"	VR 847	Red loam	Rainfed	56.82
			Salur	18º53'02"	83º17'85"	VR 847	Red loam	Rainfed	59.20
			Kurmarajupeta	18º53'73"	83º21'15"	VR 847	Red loam	Rainfed	53.86

Conclusion

The survey during *Kharif* 2020 revealed that the disease was noticed in varying intensities in seven districts surveyed. The severity was more in among the seven districts surveyed, highest mean Per cent Disesease Incidence (PDI) 56.31% was recorded in Vizianagaram district. It was followed by Chittoor, Kadapa and Kurnool, with mean Per cent Disease Incidence of 42.71, 22.27 and 20.45%, respectively. The lowest mean disease incidence 7.54% was recorded in Prakasam district followed by Anantapuram (19.37%) and Guntur (19.68%) districts. The higher incidence of disease in some locations may due to monoculture of finger millet, which could be main source for the pathogen. The disease might have appeared in severe form because of initial inoculums, build-up also farmer's practices *viz.*, high amount of nitrogen applications, improper irrigation also influences the survival and spread of inoculum and that ultimately led to highly aggregated damage to the crop.

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