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## Status and management of Bacterial leaf blight (*Xanthomonas oryzae* pv. *oryzae*) of Rice through host resistance under Jammu sub-tropics

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A survey of rice growing areas of Jammu, Kathua and Samba districts was conducted to assess the status of disease incidence. Maximum disease incidence was recorded in Kulian (45.33 per cent) of Jammu district and minimum at Jagatpur (15.21 per cent) of Kathua district. Overall disease incidence for all three districts was 33.53 per cent. Three varieties viz. Basmati-370, Pusa-1121 and IET-1410 were grown at different locations of Jammu district. Maximum disease incidence (45.33 per cent) was recorded in IET-1410 whereas minimum incidence (34.10 per cent) was recorded in Basmati-370. In Kathua district, five varieties IET-1410, Pusa-1121, Neha, PHB-71, and Basmati-370 were grown. Maximum and minimum incidence of 40.13 per cent and 15.21 per cent respectively was recorded in IET-1410 and Neha. In Samba district, three varieties i.e. Basmati-370, Neha and Ratna were grown by most of the farmers. Maximum disease incidence 40.21 per cent was recorded in Ratna while minimum incidence 15.23 per cent was recorded in Neha. Sixteen varieties were screened to find out the resistance source against the bacterial leaf blight, out of them Jaya was found susceptible with 60.22 per cent disease severity. Whereas minimum 25.21 per cent disease severity was observed in Pusa-1121. While PUSA-1121, PR-113, PB-1 and IR-10 were moderately resistant, and varieties Basmati-370, RR-8585, PC-19, IET-1410, SJR-5, IARI-1460, Ranbir basmati, Saanwal basmati, Basmati-564, Basmati-385, Ratna were moderately susceptible.

**Key words:** Disease incidence, genotypes, bacterial leaf blight, sub-tropics and survey

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### INTRODUCTION

Rice is grown on millions of small farms with an average size ranging from 0.4 to 3.5 ha, primarily to meet family needs. China and India account for roughly 50 per cent of the world's total rice area and jointly produce 55 per cent of world's rice. Cultivation of rice is an important source of income and employment generation in the rural areas of Asia (Hosain, 1997). India is the second leading producer of rice in the entire world, next to China with an annual rice production is 147.0 million tons in 42.24 million ha of cultivation (FAO, 2011). Rice constitutes 52 per cent of the total food grain production and 60 per cent of the total cereal production in India (Anon, 2010). The major rice growing states of India are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar,

Orissa, Assam, and Karnataka. More than 50 per cent of the total rice production comes from the first four states (FCI, 2010).

There are a number of constraints in rice production among which diseases are the major factors. More than 70 diseases caused by fungi, bacteria, viruses and nematodes are among the most important limiting factors that affect rice production (Song and Goodman, 2001). Rice crop is prone to number of bacterial diseases among which bacterial leaf blight (BLB) caused by *Xanthomonas oryzae* pv. *oryzae* (Xoo) is a serious problem and threat to rice production in both tropical, sub-tropical and temperate rice growing regions due to its high epidemic potential (Mew, 1987). Bacterial leaf blight is the most destructive and very serious disease causing million of tones of grain losses annually specially in rice growing countries. It has been reported from all continents of the world, except Europe (Jabeen *et al.* 2011; Ou, 1985).

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The disease occurs in the host plant at the seedlings, vegetative and reproductive stages but bacterial leaf blight infection at the tillering stage causes severe blighting of leaves resulting in yield loss up to 75 per cent depending on weather, location and particular rice cultivar used (Ou, 1985).

Keeping in view the importance of the disease, socio economic status of the crop, the losses inflicted to the farmers in terms of remuneration and inadequate research work carried on the disease particularly in rice growing areas of the Jammu and Kashmir, the present investigation was undertaken to find out the status of the BLB in Jammu subtropics and find out the resistance sources also.

## MATERIALS AND METHODS

### Survey of disease

Survey of rice growing areas of Jammu, Kathua and Samba districts was conducted to assess the status of disease incidence. Plants affected with BLB were identified by specific symptoms i.e. blight symptoms appeared on leaves of young plants, as pale-green to grey-green water-soaked streaks near the leaf tip and margins. Five fields in each location were selected for estimation of disease incidence. At each place four plants were examined. The disease incidence was calculated by using the formula of (IRRI, 1996).

$$\text{Percent disease incidence} = \frac{\text{Number of bacterial blight infected plants}}{\text{Total number of plants examined}} \times 100$$

Sixteen rice genotype viz. PUSA-1121, B-370, PR-113, RR-8585, PC-19, IET-1410, SJR-5, Jaya, PB-1, IARI-1460, Ranbir basmati, Saanwal basmati, Basmati-564, IR-10. Basmati-385 and Ratna collected from different sources were grown under field conditions at Research Farm Chatha, SKUAST-J to find out the resistance against BLB (*X. oryzae* pv. *oryzae*) Data of severity was recorded as percentage of tissue area infected out of total leaf area examined. Percentage average lesion area of 15 leaves collected was measured for disease severity in each plot using the following scale (Chaudhury, 1996).

### Disease Rating

#### Lesion size (% of leaf length) Disease Reaction

0=0 Immune, 1=1-10 Resistant, 3=11-30 Moder-

ately Resistant, 5=31-50 Moderately Susceptible, 7=51-75 Susceptible, 9=76-100 Highly Susceptible where:

$$\text{Disease Index} = \frac{n(1) + n(3) + n(5) + n(7) + n(9)}{tn}$$

**Table 1** : Disease incidence of bacterial leaf blight on paddy in Jammu Division

District	Location	Variety	PDI (%)
Jammu			
	Udheywala	B-370	40.21
	B.Bramhana	B-370	38.11
	Bhor Camp	B-370	34.10
	Gagian	Pusa-1121	15.21
	Kulian	IET-1410	45.33
	Mean		34.59
	Range		34.10-45.33
Kathua			
	Nagari	IET-1410	40.13
	Kalibari	Pusa-1121	17.15
	Jagatpur	Neha	15.21
	Rathwal	PHB-71	39.33
	Bhujwal	B-370	36.56
	Mean		29.67
	Range		15.21-40.13
Samba			
	Ramgarh	B-370	37.11
	Koh Bramhana	Neha	15.55
	Raipar	Ratna	40.21
	Sordi	Ratna	35.34
	Bainglarh	Neha	15.23
	ChakSalarian	B-370	38.32
	Mean		36.35
	Range		15.23-40.21
	Overall mean		33.53

n (1), n (3), n (5), n (7) and n (9) = Number of leaves showing severity score of 1, 3, 5, 7 and 9.  
tn = Total number of leaves scored

## RESULTS AND DISCUSSION

In order to determine the prevalence of bacterial leaf blight of paddy in Jammu, Kathua and Samba districts of Jammu division of Jammu and Kashmir, an exhaustive survey was conducted

**Table 2** : Disease reaction of different paddy genotypes against bacterial leaf blight

Variety	Disease severity (%)	Score	Disease reaction
PUSA-1121	25.21	3	MR
B-370	38.11	5	MS
PR-113	27.45	3	MR
RR-8585	39.34	5	MS
PC-19	42.77	5	MS
IET-1410	42.21	5	MS
SJR-5	45.33	5	MS
Jaya	60.22	7	
PB-1	30.55	3	MR
IARI-1460	40.65	5	MS
Ranbir basmati	35.22	5	MS
Saanwal basmati	38.33	5	MS
Basmati-564	40.72	5	MS
IR-10	27.22	3	MR
Basmati-385	38.33	5	MS
Ratna	45.21	5	MS

during *kharif* 2015 at boot leaf stage of the crop. The data presented in Table 1 revealed that the disease incidence in Jammu district, ranged from 34.10 to 45.33 per cent with the mean of 34.59 per cent. In Kathua district disease incidence ranged from 15.21 to 40.13 per cent with mean of 29.67 per cent while in Samba district the incidence ranged from 15.23 to 40.21 per cent with mean of 36.35 per cent. Maximum disease incidence was recorded in Kulian (45.33 per cent) of Jammu district and minimum at Jagatpur (15.21 per cent) of Kathua district. Overall disease incidence for all three districts was 33.53 per cent.

Three varieties viz. Basmati-370, Pusa-1121 and IET-1410 were grown at different locations of Jammu district. Maximum disease incidence (45.33 per cent) was recorded IET-1410 whereas minimum incidence (34.10 per cent) was recorded in Basmati-370. In Kathua district, five varieties IET-1410, Pusa-1121, Neha, PHB-71, and Basmati-370 were grown. Maximum and minimum incidence of 40.13 per cent and 15.21 per cent respectively was recorded in IET-1410 and Neha. In Samba district, three varieties i.e. Basmati-370, Neha and Ratna were grown by most of the farmers. Maximum disease incidence 40.21 per cent was recorded in Ratna while minimum incidence 15.23 per cent was recorded in Neha. The incidence of bacterial leaf

blight of rice was differed in district to district as well as location to location. It might be variation in the field topography, environment conditions of the particular location and fertility status of the soil. There are several reports that bacterial leaf blight is favored by high nitrogen level and incidence was less when crop is supplemented with potassic fertilizers (Manzoor *et al.* 2017; Chaudhary *et al.* 2009). Similar finding have also been advocated by Ali *et al.* (2009) that 26.50 per cent disease incidence in Basmati-385, 20.70 per cent in IR-6, 27.27 per cent in Kashmir Basmati and 26.80 per cent in Basmati-370 at Malakand in Pakistan.

The data presented in Table 2 revealed that maximum severity was observed on Jaya (60.22 %) whereas, minimum severity was observed on Pusa-1121 (25.21 per cent). Out of twenty varieties none of the variety was found immune against *X. oryzae* pv. *oryzae*. Four varieties i.e. PUSA-1121, PR-113, PB-1 and IR-10 were found as moderately resistant, eleven varieties viz. B-370, RR-8585, PC-19, IET-1410, SJR-5, IARI-1460, Ranbir basmati, Saanwal basmati, Basmati-564, Basmati-385, Ratna were categorized as a moderately susceptible and one variety Jaya as susceptible.

Sixteen varieties were screened to find out the resistance source against the bacterial leaf blight, out of them Jaya was found susceptible with 60.22 per cent disease severity. Whereas minimum 25.21 per cent disease severity was observed in Pusa-1121. While PUSA-1121, PR-113, PB-1 and IR-10 were moderately resistant, and varieties Basmati-370, RR-8585, PC-19, IET-1410, SJR-5, IARI-1460, Ranbir basmati, Saanwal basmati, Basmati-564, Basmati-385, Ratna were moderately susceptible. These findings are in accordance with the finding of Khan *et al.* (2009) was screened basmati 385 and basmati 370 found moderately susceptible reactions against *X. oryzae* pv. *oryzae*. Similarly results were also reported by Shah (2008), who evaluated the basmati 385 against *X. oryzae* pv. *oryzae* in Pakistan. Similar findings have been reported by Singh (1999) that, cultivars IR-8, Jaya, Parmal and PC-19 are being grown on commercial scale in the entire rice growing sub tropical belt of Jammu these varieties are having known susceptibility to *Xoo* and is the region for the high incidence of disease in the area. Gupta *et al.* (2012) reported that bacterial leaf blight caused by *X. campestris* pv. *oryzae* mostly appears in lower belt of Jammu region, particularly basmati rice culti-

vated areas. This disease also causes significant crop loss in the state. All the commercial basmati varieties cultivated in Punjab are found moderately susceptible to highly susceptible to BLB disease (Cheema *et al.* 1998; Khan *et al.* 2000ab; Akhtar *et al.* 2008; Khan *et al.* 2008). Jalaluddin *et al.* (1998) screened and evaluated fourteen advanced mutants along with five check varieties of rice for their resistance to bacterial leaf blight (*X. oryzae* pv. *oryzae*) and sheath blight (*Rhizoctina solani*) during four consecutive transplanted (T) aman seasons from 1994-1997. For bacterial blight, flag leaves were inoculated with the causal bacterium ( $10^8$  cell/ml) by clipping method. All the induced mutants and the check varieties TKM6, Binasail, BR9 and BR 14 were moderately susceptible to bacterial leaf blight. Jalaluddin *et al.* (1999) screened and evaluated four somaclonal progenies of rice variety BR3 along with four check varieties for their resistance to bacterial leaf blight (BLB) caused by *X. oryzae* pv. *oryzae* and sheath blight caused by *Rhizoctonia solani* during the aman and boro seasons of 1990-1993. All the somaclonal progenies were moderately susceptible to BLB in both aman and boro season.

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