

A Survey on Banded Leaf and Sheath Blight of Maize Incited by *Rhizoctonia solani* f. sp. *sasakii* in Himachal Pradesh

Banita Devi^{2*} Bhag Ram Thakur¹ and Gurvinder Singh²

¹Department of Plant Pathology, College of Agriculture, CSKHPAU, Palampur, H.P. 176062, India

²Department of Plant Pathology, UHF, Nauni -Solan, H.P. 173230, India

*Corresponding Author E-mail: thakurbanita91@gmail.com

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ABSTRACT

Banded leaf and sheath blight of maize is caused by a destructive and versatile pathogen *Rhizoctonia solani* f. sp. *sasakii*. To assess the occurrence of banded leaf and sheath blight (BLSB) of maize in Himachal Pradesh, an extensive survey was conducted during the month of August, 2013 in five districts of Himachal Pradesh viz., Kangra, Mandi, Hamirpur, Una and Bilaspur to record the incidence and severity index of the disease. The disease occurred throughout the state with maximum incidence of 58.8 % at Bilaspur followed by Una (52.8 %), Kangra (38.4 %), Mandi (34.3%) and Hamirpur (30.0 %) with average severity index of 61.0, 66.5, 45.9, 41.3 and 42.2 % respectively. The cultural and sclerotial characteristics of different isolates collected from different locations were recorded.

Key words: Banded leaf and Sheath blight (BLSB), Incidence, Maize, Severity index and Survey

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops in the world. Maize grain has about 10% protein, 4% oil, 70% carbohydrates, 2.3% crude fiber, 10.4% albuminoids and 1.4% ash. Maize has significant quantities of vitamin A, nicotinic acid and riboflavin. Of more than one hundreds diseases of maize reported so far from different parts of the globe, 65 are known to occur in India. Bacterial stalk rot, turcicum blight, head smut and banded leaf and sheath blight of maize are of major economic importance. Banded leaf and sheath blight, caused by a destructive and versatile pathogen

Rhizoctonia solani f. sp. *sasakii* (teleomorph: *Corticium sasakii*, syn. *Thanatephorus cucumeris*), causes losses in grain yield ranging from 11.0 to 40.0 per cent¹.

The disease was first described and reported from Sri Lanka⁴ as sclerotial disease of maize caused by *Rhizoctonia solani* Kuhn. The *sasakii* group of *R. solani* Kuhn attacks graminaceous hosts and causing distinct symptoms of bands on leaf and sheath and therefore, can be distinguished as a forma specialis *R. solani* f. sp. *Sasakii*³. In India, this disease was first reported from Tarai region of Uttar Pradesh⁵.

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The pathogen is characterized by formation of dull brown sclerotia on the hosts. Ahuja and Payak³ found that maximum damage is caused when ears are infected. Keeping in view the significance of losses caused by this disease an attempt has been made to ascertain the prevalence of this disease in maize growing area of Himachal Pradesh.

MATERIAL AND METHODS

To assess the occurrence of Banded Leaf and Sheath Blight of maize in Himachal Pradesh, an extensive survey was conducted during the

month of August, 2013. Five districts of Himachal Pradesh viz., Kangra, Mandi, Hamirpur, Una and Bilaspur were surveyed to record the incidence and severity index of the disease from farmer's field. At each location, five maize growing fields were selected for disease indexing. In each field, populations of fifty plants were assessed for incidence, from which twenty infected plants were assessed for severity level. Disease severity index was assessed using 1-9 scale suggested by Ahuja and Payak², as follows:

Disease scale	Description of symptoms
1	Disease on one leaf sheath only; few small, no coalescent lesions present
2	Disease on two sheaths; lesions large and coalescent
3	Disease up to four sheaths, lesions many and always coalescent
4	As in scale 3 + rind discolored with small lesions
5	Disease on all sheaths except two internodes below the ear
6	Disease up to one internode below the ear shoot; rind discoloration on many internodes with large depressed lesions
7	Disease up to internode bearing the ear shoot but shank not affected
8	Disease on the ear; husk leaves show bleaching, bands and caking among them-selves as also of silk fibers; abundant fungal growth between and on kernel rows; kernel formation normal except their being lusterless; ear size less than normal; some plant prematurely dead
9	In addition to scale 8, shrinkage of stalk; reduced ear dimensions; wet rot and disorganization of ear; kernel formation absent or rudimentary; premature dead plants common; abundant sclerotia production on husk leaves, kernels, ear tips or silk.

Data were pooled at the end to work out per cent incidence and severity index as follow:

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

$$\text{PDI (Per cent disease intensity)} = \frac{\text{Sum of all the ratings}}{\text{Total number of ratings} \times \text{maximum disease score}} \times 100$$

RESULTS AND DISCUSSION

Survey

To assess the status and distribution of banded leaf and sheath blight (BLSB) of maize in Himachal Pradesh, an extensive survey of 5 districts (Table 1) were conducted during the month of August, 2013. The data revealed that its prevalence was widespread throughout the maize growing areas of the state. On an average, the maximum incidence was occurred in the district of Bilaspur (58.8%) followed by

Una (52.8%), Kangra (38.4%), Mandi (34.3%) and Hamirpur (30.0%) with average severity index of 61.0, 66.5, 45.9, 41.3 and 42.2%, respectively.

In Bilaspur district, maximum disease incidence was recorded at Berthin (62.8%) and minimum at Ghumarwin (53.5%) with an average of 58.8%. Disease severity was ranged from 53.5 (Ghumarwin) to 62.8% (Berthin) with an average of 61.0% in the district. Though the disease incidence was low in Una

with an average of 52.8% ranged from 45.5 (Akrot) to 60% (Amb), but severity index was maximum with an average of 66.5% ranged from 65 (Akrot) to 68% (Amb).

In Kangra district, the average disease incidence was 38.4% with severity level of

45.9%. The average disease incidence in Mandi district was 34.3% with severity index of 41.3%. In Hamirpur district, the average disease incidence was 30.0% with severity index of 42.2% (fig. 1).

Table 1. Prevalence of banded leaf and sheath blight in different maize growing areas of Himachal Pradesh

District	Location	Per cent incidence	PDI*
Kangra	Bir	40.0	47.0
	Palampur	36.8	44.7
	Mean	38.4	45.9
Mandi	Jogindernagar	40.0	43.3
	Majharnu	35.0	40.6
	Ghatasani	28.0	40.0
	Mean	34.3	41.3
Bilaspur	Berthin	62.8	65.0
	Bagehar	60.0	56.1
	Ghumarwin	53.5	62.0
	Mean	58.8	61.0
Hamirpur	Nadaun	32.0	43.5
	Sujanpur	28.0	41.0
	Mean	30.0	42.2
Una	Amb	60.0	68.0
	Akrot	45.5	65.0
	Mean	52.8	66.5

PDI* = Per cent disease intensity

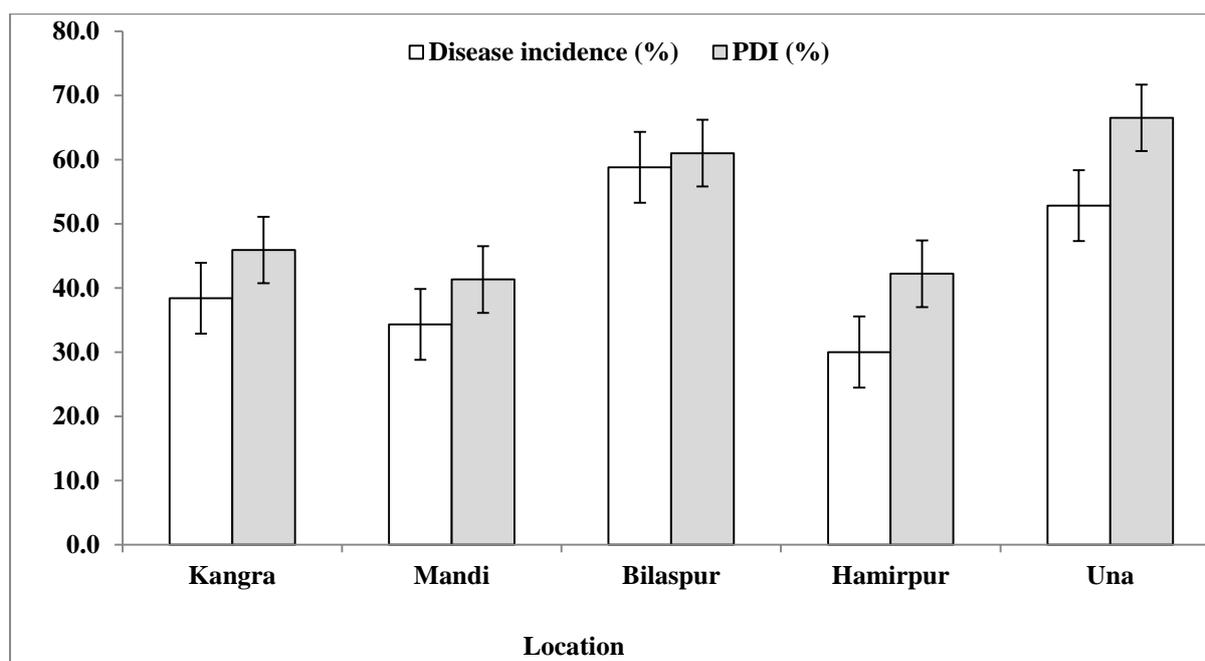


Fig. 1: Per cent disease incidence and severity of Banded Leaf and Sheath Blight of maize in Himachal Pradesh

Payak and Sharma⁶ also reported the occurrence of the disease from different regions of India. Thakur *et al.*⁷ reported an epidemic in warm and foot hill areas, particularly in Mandi district of Himachal Pradesh.

Pathogen identification

b) Cultural and sclerotial characteristics:

The pure culture of all five isolates Rs₁, Rs₂, Rs₃, Rs₄ and Rs₅ were maintained on PDA medium and incubated at 25±1°C. After 3-4 days of inoculations, all the Petri plates were completely filled with mycelium. The cultural

and sclerotial characteristics were noticed (Table 2). The Palampur (Rs₁), Ghatasani (Rs₅) and Nadaun (Rs₂) isolates have hyphoid mycelium with creamish brown to pale brown colony colour having smoky brown sclerotia in ring pattern. Whereas, Berthin (Rs₄) and Amb (Rs₃) have dense and thin mycelium with pale brown colony colour having uniform sclerotial distribution (Plate 1). Thus, the morphological and cultural characteristics with sclerotial formation confirm the casual fungus as *R. solani* f. sp. *sasakii* to cause BLSB of maize.

Table 2. Cultural and sclerotial characteristics of isolates of *Rhizoctonia solani* f.sp. *sasakii*

Isolates	Location	Appearance of mycelium	Colony Colour	Distribution Pattern of sclerotia	Type of sclerotia	Sclerotia Colour
Rs-1	Palampur	Hyphoid	Creamish brown	Ring pattern	Coalescent	Smoky brown
Rs-2	Hamirpur	Hyphoid	Creamish brown	Ring pattern	Coalescent	Smoky brown
Rs-3	Amb	Thin	Pale brown	Uniform	Coalescent	Dark brown
Rs-4	Berthin	Dense	Creamish brown	Uniform	Coalescent	Smoky Brown
Rs-5	Ghatasani	Hyphoid	Pale Brown	Ring Pattern	Coalescent	Dark brown

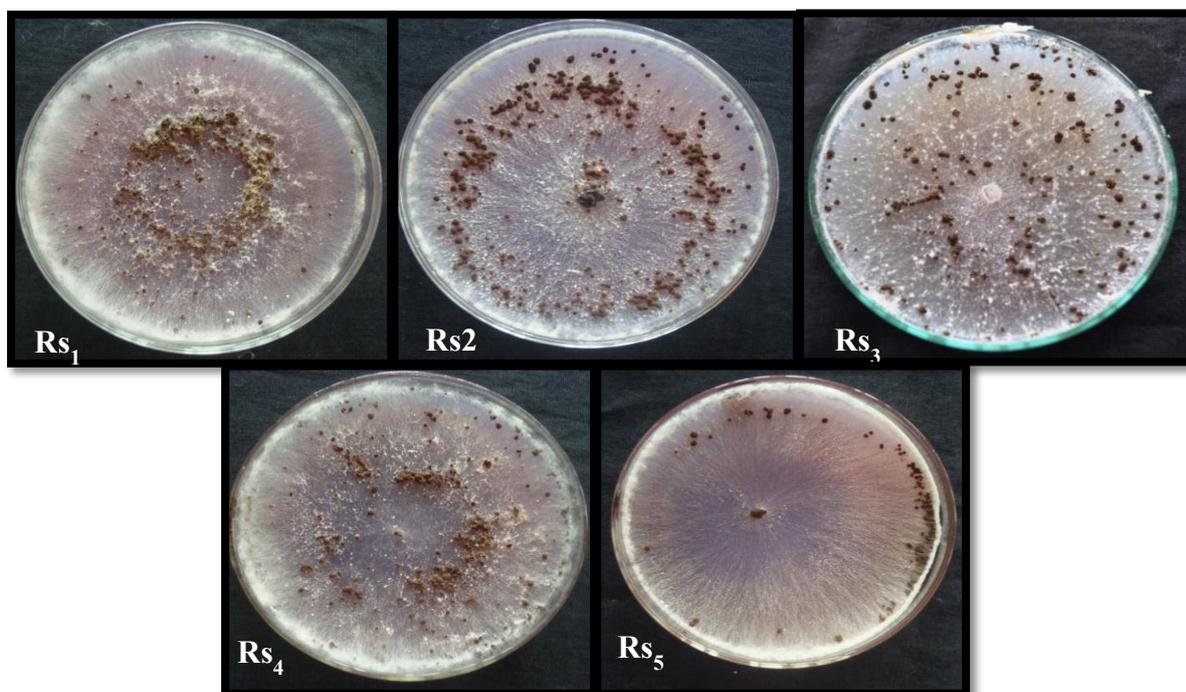


Plate 1 Cultural and sclerotial characteristics isolates 1- Rs₁, 2 - Rs₂, 3- Rs₃, 4- Rs₄, 5-Rs₅ 6- Rs₂ of *R. solani* f. sp. *sasakii*

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