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Isolation of Sheath Blight Pathogen, its Pathogenicity and Survey of Incidence in Rice Field

Vipin Kumar, V. P. Chaudhary, Prashant Mishra, Rajbir Singh, Satpal Singh

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Abstract Sheath blight (SB) of rice caused by *Rhlzoctonia solani* Kuhn is a major biotic constraint of rice in most of the rice growing countries of Asia. The pathogen is polyphagous competitive saprophyte and has a wide host range, collection of infected samples were carried out isolation of *Rhlzoctonia solani* (pathogen) and its pathogenicity test. Initial symptoms of sheath blight appear in the form of circular, oblong or ellipsoid, greenish, grey, water soaked spots of about 10 mm long that occur on leaf sheaths near the water line. An extensive survey of rice field was carried out at seven places, to find out the isease incidence and severity of sheath blight caused by *Rhizoctonia solani* in *kharif* 2011. The maximum disease incidence 43.0% and maximum severity 45.0% was recorded in October at the agronomy farm. The minimum disease incidence 11.0% and minimum severity 11.0% was recored in August.

Keywords Isolation, Pathogenicity, Field survey, Sheath blight incidence, Rice.

Introduction

Rice (*Oryza sativa* L.) is the most important staple food crop and grown in India providing of 43% of calorie requirement for more than 70% of the Indian population of the world. According to Globally, rice annual production of aroumd 497.9 million tonnes with average productivity of 3.9 tonnes/ha (2016) [1]. The annual production of rice in the country is around 103.36 million tonnes and the average productivity in the country across all the ecosystems is still around 2 tonnes/ hectare of milled rice . Uttar Pradesh is largest rice growing state covering an area of 6.93 million hectare with total production of 12.91 million tonnes and average productivity 1862 kg/ha [1]. There are several biotic abiotic and environmental factors behind the less productivity of rice crop, resulting in low yield and quality. Sheath blight (SB) is a fungal disease of rice caused by a necrotrophic soil-borne fungus *Rhizoctonia solani*

Vipin Kumar*, V. P. Chaudhary
Department of Plant Pathology,
ND University of Agriculture and Technology,
Kumarganj, Faizabad 224229, India

Prashant Mishra, Satpal Singh
Department of Plant Pathology,
Sardar Vallabhbhai Patel University of
Agriculture and Technology,
Meerut 250110, India

Rajbir Singh
Department of Plant Pathology,
Gochar Mahavidyalaya Rampur Maniharan,
Saharanpur 247451, India
e-mail : vipinsre489@gmail.com
* Correspondence

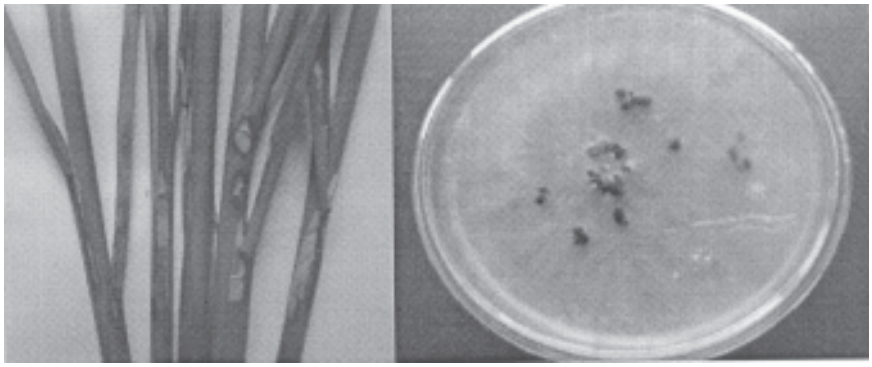

Fig. 1. Symptoms of sheath blight of rice culture of *Rhizoctonia solani.*

(teleomorph) : thnaptephorus cucumeris (Frank) Donk) which was first identified as a parasite of potato in 1898 by Kuhn [2]. Sheath blight in rice was first reported in 1910 in Japan [3]. In India this disease was reported in 1960, first time from Gurdaspur [4]. Sheath blight caused by Rhizoctonia solani is emerging as a very destructive disease under favorable weather conditions in rice growing areas of the world which ultimately causes substantial yield losses [5]. The generally recommended varieties (Jaya, Pusa Basmati-1 and IR8) have shown susceptibility under artificial inoculation condition [6]. The growth of mycelium on the affected parts of the plant under conditions and this aids in the spread of the disease to a considerable distance in the field through irrigation water [7]. The germination rate of sclerotia increased with temperature and can infect rice plants at a soil depth of 1-3 cm. Reported that 60.9% sclerotia could survive after 265 days of being buried in natural sandy loam under field conditions in beijing, while colonized rice straw debris (0.5-10 cm long) could not yield the fungus on medium plates after 88 days of being buried under same conditions [8]. It has been reported that in China 15 to 20 million hectares of rice field affected by SB instigates yield losses of 6 million tons every year [9]. In the USA, crop losses due to rice SB have been recorded as up to 50% in susceptible cultivars [10].

Materials and Methods

Collection, isolation and pathogenicity

Diseased plants showing sheath blight symptom were collected fro different locations of rice growing areas near ND University campus were surveyed during the crop season. The samples were kept in clean polythene bag and each sample was marked clearly to show details of the location. The samples were brought to the laboratory for microscopic examination, isolation, purification and pathogenicity test (Fig.1). For the isolation of causal organism , after taking diseased rice leaf, sheath and stem, small pieces of diseased portion sowing typical symptoms along with healthy tissues were cut with the help of sterilized blade. These pieces washed thoroughly with the tap water and placed into 0.1% mercuric chloride solution followed by washing thrice with sterilized water thoroughly. Excess water was removed by placing on the folds of sterilized blotting paper. Dried pieces were aseptically transferred into petri-dish containing potato dextrose agar medium with the help of a sterilized forceps. Petri dishes were properly marked with glass marker and incubated at 26 $\pm 1^0$C in BOD incubator . *R. solani* isolates of rice grew 66.6% faster than potato isolates reported [11].

Survey of rice field

An extensive survey of rice field was carried out at seven places such as Agronomy farm, Students Instructional farm, Bawan, Bharat Kapara, Baraipara and Main Experiment Station of Directorate of research in the University to find out the incidence and severity of sheath blight caused by *R. solani* in *kharif* 2011 transplanting to harvesting period of the crop in different rice growing are as nearby village

Table 1. Scordingof sheath blight (IRRI-1979).

Disease rating scale	Description
0	No. infection
1	Vetical 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 lesions up to 31-45% of plant height.
7	Vertical spread of the lesions up to 46-65% of plant height.
9	vertical spread of the lesions up to 66-100% of plant height.

of the University and farms field was randomly selected for survey, four field in each village as well as students Instructional farm, Agronomy farm and Main Experiment station of Directorate of Research in the University were chosen for recording disease incidence and disease severity. Disease severity was recorded from ten randomly selected plants from each field by using 0-9 SES scale [12] (Table 1) and percent disease incidence was calculated using the formula as given below :

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

Naturally infected leaves and others plants part showing characteristic symptoms of sheath blight were collected from each rice field surveyed at different growth stages of the crop and brought to the laboratory for critical examinations, symptoms description and isolation of the causal pathogen. All the samples were properly pressed, labeled and kept in the dry and wet preservation for further studies.

Results and Discussion

Collection of infected disease samples of rice growing areas near ND University campus were surveyed during the crop season. Diseased plants showing sheath blight symptom were collected from different locations. The isolation of causal organism (*R. solani*) after two days of incubation fungal growth appeared in slants for further studies. The pathogen was identical on the basis of their cultural and morphological characters. The colonies of the fungus grew fast, usually white to brown after five days of incubation. The color of mycelium was white in beginning which later turns tan brown with age and branched near the distal septum of mother hypha cell at right angles. Sclerotia were dark brown, round to irregular and consisted of brown and whites morphological character of the fungus has also been described [13]. Pathogenicity done during this investigation revealed that the pathogen could reproduce the similar symptoms of the disease after 5-6 days of inoculation. Similarly pathogenicity of fungus was established on the same host by earlier worker [5, 14].

Survey of sheath blight incidence

The maximum disease incidence (18.0%) was recorded in Bawan, Bhartkapara and khandasa. The minimum disease incidence (11.0%) was recorded at Main experimental station, Kumargang, Fazaibad. Maximum disease severity (26.0%) was recorded in Khandasa village during the August-2011 (Table 2).

Table 2. Incidence, severity and distribution of sheath blight of paddy in different crop session 2011 as given under.

Sl. No.	Locations	August		September		October	
		Incidence %	Severity %	Incidence %	Severity %	Incidence %	Severity %
1	Agronomy farm	15	12	28	28	43	45
2	MES	11	11	24	24	40	42
3	Students Instructional farm	15	15	35	34	38	44
4	Bawan	18	20	34	35	39	45
5	Bharkapara	18	14	22	22	35	40
6	baraipara	14	20	34	32	40	45
7	Khandas	18	26	38	40	41	45

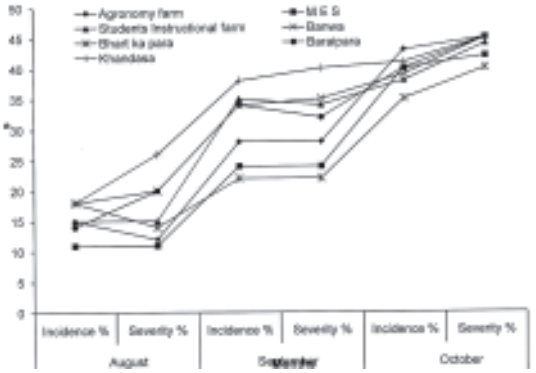

Fig. 2. Survey of rice fields for incidence and severity of sheath blight *kharif*-2011.

Likewise, the maximum incidence (38.0%) was recorded along with the disease severity (40.0%) in Khandasa village during of September to October the disease incidence was maximum (43.0%) at Agronomy farm followed by Khandasa village (41.0%). The disease severity (45.0%) was recorded at four locations like as Agronomy farm, Bawan, Bhartkapara, as well as Khandsa village month of the October 2011 (Fig. 2).

Conclusion

The disease symptoms of sheath blight after collection, isolation and purification with test pathogenicity. Maximum disease incidence was recorded in Bawan, Bhartkapara and khandasa with highest disease severity ewas observed in Khandasa. These results can be exploited for recommendations manage of sheath blight disease of paddy.

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