



STUDIES ON SHEATH BLIGHT INCIDENCE OF RICE IN NELLORE AND CHITTOOR DISTRICTS OF ANDHRA PRADESH

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ABSTRACT

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A roving survey was conducted during *rabi*, 2020-2021 in Nellore and Chittoor districts of Andhra Pradesh to assess the disease severity of sheath blight disease in rice. The per cent disease severity ranging from 6.11 to 13.44 per cent was noticed. Maximum disease severity (13.44%) was recorded at Kothapalem village of Nellore district while minimum (6.11%) was recorded at Narasingapuram village of Chittoor district. The maximum disease was observed from tillering stage to harvesting stage.

KEYWORDS: Survey, sheath blight, rice, *Rhizoctonia solani*.

INTRODUCTION

Rice is the most important staple food crop in the world. Rice being a tropical plant, it can flourish in hot and humid climate. It can be grown in both *Kharif* & *Rabi* seasons. Rice is attacked by a number of fungal, bacterial and viral diseases. Among the fungal disease rice sheath blight is regarded as an internationally important disease. Sheath blight is a soil borne disease caused by the fungus *Rhizoctonia solani* Kuhn AG1-IA. This disease causes significant yield losses about 11.1-58.0 per cent depending on variety and stage of the crop (Chahal *et al.*, 2003).

Studies on the survey of disease in an area to know the current status of the disease in the various rice growing districts is essential to take decision regarding management of the disease. (Gangopadhyay and Chakrabarti, 1982). In India, this disease was first reported in Punjab, and later in Uttar Pradesh. Further, the disease was reported in Tamil Nadu, Kerala, Andhra Pradesh and Kashmir (Reddy and Reddy, 1986). Disease has been spreaded widely in terms of both occurrence and intensity over the past twelve years. It has become more prevalent on the improved varieties *viz.*, BPT 5204, JGL1798, JGL 384, Swarna, MTU1010, MTU1061 and MTU1075 (Prakasam *et al.*, 2013). The management of sheath blight of rice is to reduce the primary source of inoculum by killing sclerotia or to inhibit their germination. The disease has been efficiently controlled by the use of systemic and non-systemic fungicides to seed, soil or foliage applications (Rabindran and Vidhyasekaran, 1996). Because of the hazardous residual effects of chemical fungicides in soil, in recent

years several researches have been carried out to assess the potentiality of bio control agents for management of sheath blight, through the application of antifungal bacterial strains isolated from the soil (Nandakumar *et al.*, 2001). Distribution of *Bacillus* spp. in different ecological habitats and its endospore forming ability, sheath blight disease more possibly controlled by effective strains of *B. subtilis* among others bio control agents (Qin and Zhang, 2005).

MATERIAL AND METHODS

Roving survey was conducted during *Rabi* 2020-21 in major rice growing areas of Chittoor and Nellore districts. In each district, 3 mandals were selected, in each mandals 3 villages were taken. From each village, 3 fields were surveyed to study the disease severity of sheath blight disease.

Four one squire meter quadrants were randomly selected in each field and infected plants were counted in each quadrant based on relative lesions height. The disease severity was calculated based on a scale developed by IRRI, 2002.

Rating scale (based on relative lesion height)

0 - No infection observed

1 - Lesions limited to lower 20% of the plant height

3 - Lesions limited to 20-30% of the plant height

5 - Lesions limited to 31-45% of the plant height

7 - Lesions limited to 46-65% of the plant height

9 - Lesions observed more than 65% of the plant height

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Per cent disease index (PDI) was calculated as per the following formula given by Wheeler (1969).

PDI =

$$\frac{\sum \text{ of individual disease ratings}}{\text{Number of plants scored} \times \text{Maximum disease scale}}$$

Collection of Sheath blight symptoms

During survey characteristics symptoms on the leaf sheath at water level and the lesions in its early stages were circular or oblong with dark brown margin. The lesions were usually confined to the lower leaf sheaths at or near the water level described by Paracer and Chahal (1963). Those diseased samples were collected for isolation of *R. solani* Kuhn pathogen.

Isolation of pathogen

The causal organism *R. solani* Kuhn was isolated from the rice plants showing typical sheath blight symptoms under field conditions. Leaf sheath showing typical symptoms was washed in tap water for few minutes and leaf bits of 3-8 mm size were surface sterilized with 1% sodium hypochloride for one minute and then rinsed with sterile distilled water to remove the traces of sodium hypo chlorite. These leaf bits are then transferred to potato dextrose agar medium in petriplates and kept for incubation at $28 \pm 2^{\circ}\text{C}$. When the growth of the fungus from the leaf bits was seen on the PDA surface, the hyphal bits from the periphery of the culture growing in the petriplates was transferred to the PDA in culture tubes. The culture was purified by hyphal tip method and pure culture was maintained on PDA by regular sub culturing at frequent intervals. Pathogenicity of *R. solani* was proved by mycelial ball insertion technique as observed by Park *et al.*, (2008) and Nadarajah *et al.*, (2014).

RESULTS AND DISCUSSIONS

The survey data is presented in the table 1. The data indicated that among the all locations surveyed, Nellore district recorded the per cent disease severity ranging from 8.7 to 13.44 while Chittoor district recorded comparatively less disease severity ranging from 6.11 to 12.36 per cent.

In Nellore District, the highest disease severity (13.44%) was recorded in Kothapalem (13.44%) of T.P Gudur (M), whereas the least disease severity (8.7%) was observed in Madharaj gudur of Nellore rural (M).

In Chittoor district, the highest disease severity was recorded in Reddivari palli (12.36%) of Chandragiri (M) whereas the least disease severity was observed in

Narasingapuram (6.11%) of Chandragiri (M).

Stage of the crop

During the survey, the disease severity was recorded at different stages of rice crop. In eight villages disease severity was observed during panical initiation stage of the crop, in one village it was during the booting stage, in one village during the dough stage, in four villages it was during the grain filling stage and in four villages during the harvesting stage. Per cent disease severity during the panical initiation stage varied from 6.11 per cent to 13.44 per cent, whereas during the grain filling and harvesting stages it ranged from 8.33 per cent to 13.32 per cent and 8.14 per cent to 12.36 per cent respectively. In Nellore districts surveyed maximum severity was recorded during panical initiation stage and in Chittoor district surveyed maximum severity was recorded during harvesting stage.

In Nellore district, severity ranging from 9.81 per cent (Kothakaluva, Nellore rural (M)) to 13.44 per cent (Kothapalem, T.P gudur (M)) was recorded during the panical initiation stage whereas disease severity during the grain filling stage varied from 8.7 per cent (Madharaj gudur, Nellore rural (M)) to 13.32 per cent (Labur-1, Indhukur peta (M)). Disease severity during the harvesting stage was recorded only in Akuthota (10.35%) of Nellore rural (M), during the dough stage was recorded only in Jagadekapeta (11.43%) and booting stage was recorded only in Narayanareddy peta (9.99%) of Indukur peta (M).

In Chittoor district, panical initiation stage recorded disease severity ranging from 6.11 per cent (Narasingapuram, Chandragiri (M)) to 8.51 per cent (Gajulamadyam, Renigunta (M)). Disease severity observed during the harvesting stage of crop ranged between 8.14 per cent (Athur, Renigunta (M)) and 12.36 per cent (Reddivari palli, Chandragiri (M)) whereas disease severity during grain filling was observed only in Mittapalem (8.33%) of Chandragiri (M).

Crop variety

The per cent disease severity recorded in each variety varied depending upon the place of cultivation. MTU1010 variety was cultivated in six villages had disease severity ranging from 8.14 (Athur, Renigunta (M)) to 13.44 per cent (Kothapalem, T.P gudur (M)), NLR3449 variety was cultivated in three villages had disease severity ranging from 9.81 per cent (Kothakaluva, Nellore rural (M)) to 13.32 per cent (Labur-1, Indukur peta (M)) and ADT 37 variety was cultivated in seven villages disease severity ranged from 6.11 per cent in Narasingapuram village to 12.36 per cent in Reddivari palli, village of Chandragiri

Table 1: Occurrence and distribution of sheath blight of rice in Chittoor and Nellore districts.

S. No.	Name of the District	Name of the Mandal	Name of the Village	Soil type	Rice variety	Crop stage	Disease severity (PDI)	Latitude (Degrees)	Longitude (Degrees)
1	Nellore	T.P Gudur	Varigunda bit	Clay loamy	NLR-3354	Grain filling	12.77 (20.92)**	14.405462	80.041044
			Kotha palem	Clay loamy	MTU-1010	Panical initiation	13.44 (21.49)**	14.457603	80.11409
			Pedur	Clay loamy	MTU-1010	Panical initiation	12.95 (21.08)**	14.436321	80.072525
			Jagadekapeta	Clay loamy	NLR-34449	Dough stage	11.43 (11.12)**	14.47986	80.069124
			Labur 1	Clay loamy	NLR-34449	Grain filling	13.32 (19.78)**	14.491693	80.066651
			Narayanareddy peta	Clay loamy	MTU-1010	Booting stage	9.99 (18.40)**	14.476833	80.663622
			Kothakaluva	Clay loamy	NLR-34449	Panical initiation	9.81 (18.20)**	14.46782	80.034808
			Akuthota	Clay loamy	NLR-3396	Harvesting	10.35 (18.75)**	14.42797	80.00156
			Madharaj gudur	Clay loamy	MTU-1010	Grain filling	8.7 (17.03)**	14.37824	80.038768
			2	Chittoor	Chandragiri	Mittapalem	Clay loamy	ADT-37	Grain filling
Reddivaripalli	Clay loamy	ADT-37				Harvesting	12.36 (20.57)**	13.604789	79.313901
Narsingapuram	Clay loamy	ADT-37				Panical initiation	6.11 (14.29)**	13.605866	79.34514
Gajulamadyam	Clay loamy	ADT-37				Panical initiation	8.51 (16.93)**	13.609427	79.508246
Athur	Clay loamy	MTU-1010				Harvesting	8.14 (16.51)**	13.579302	79.523961
Ammavaripatnam	Clay loamy	MTU-1010				Harvesting	9.29 (17.69)**	13.5777103	79.526051
Perumallapalli	Clay loamy	ADT-37				Panical initiation	8.15 (16.54)**	13.610073	79.349807
C.Mallavaram	Clay loamy	ADT-37				Panical initiation	6.66 (14.93)**	13.596201	79.353069
Satharbailu	Clay loamy	ADT-37				Panical initiation	7.77 (16.09)**	13.593061	79.35684
							2.21 (2.24)**		
							0.77 (0.78)**		
							1.08 (1.10)**		
							13.47 (7.42)**		

Note: Mean of three replications.

**Figures in parentheses are angular transformed values



Plate 1. Sheath blight symptoms on rice under field conditions observed during survey.

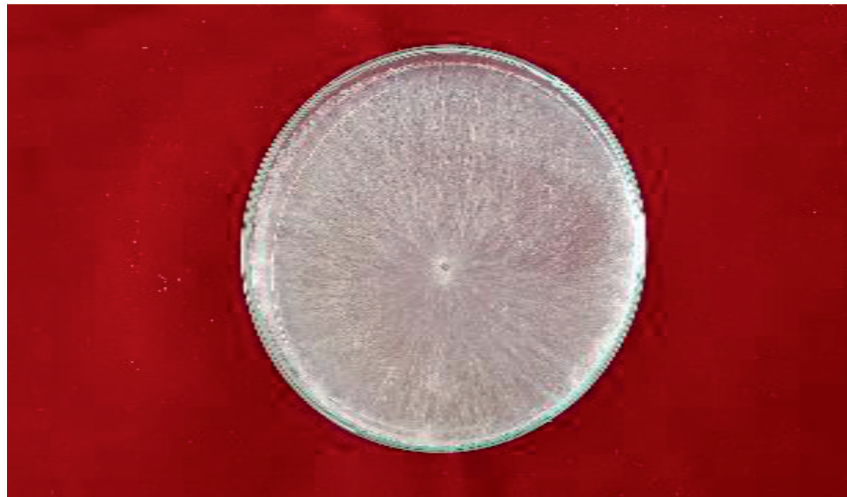


Plate 2a. Pure culture of *R. solani*.

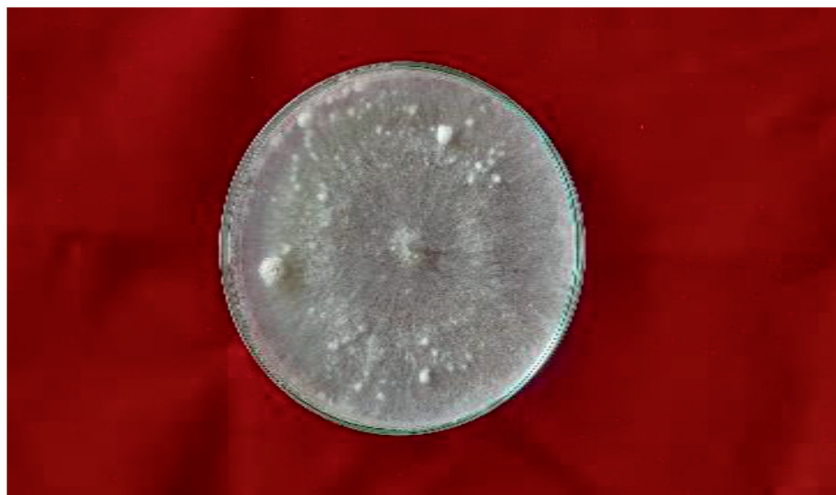


Plate 2b. Immature sclerotia of *R. solani* *in vitro*.

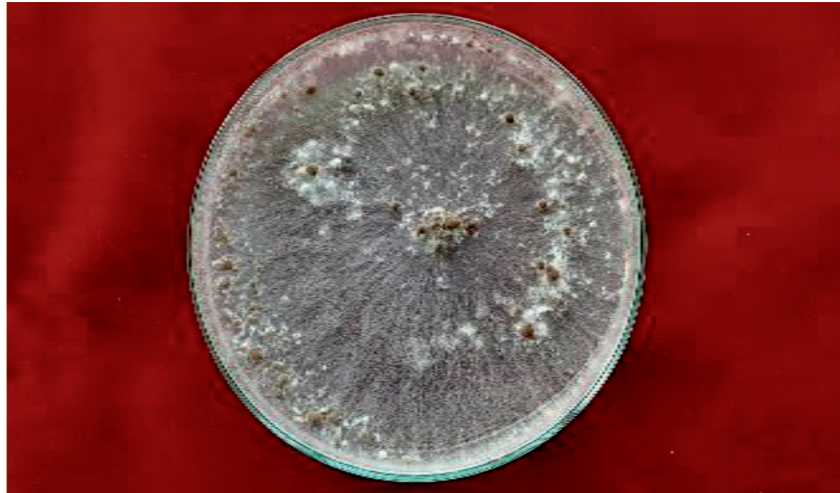


Plate 2c. Mature sclerotia of *R. solani* *in vitro*.

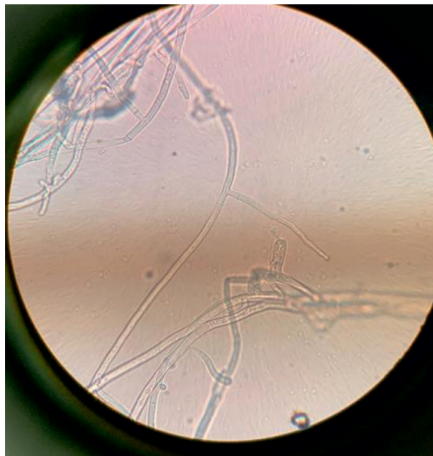


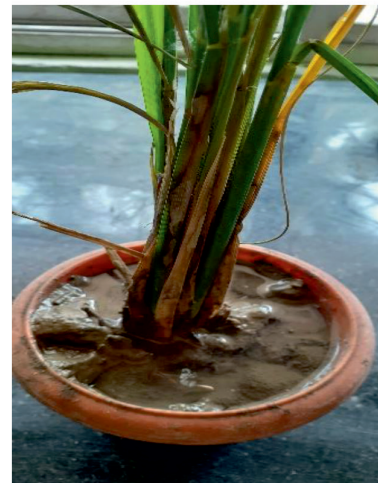
Plate 2d. Right angle branch of *R. solani*.



a) Control



b) Inoculated with sheath blight covered with aluminium foil



c) Appearance of disease symptoms after three days of inoculation of pathogen

Plate 3. Proving the pathogenicity of *R. solani* by mycelial ball insertion technique.

(M), whereas NLR3354 variety was cultivated only one village Varigunda bit (12.77%) of T.P gudur(M) and NLR3396 variety was cultivated in Akuthota (10.35%) of Nellore rural (M).

In Nellore district, disease severity in MTU1010 variety ranged from 8.7 per cent (Madharaj gudur, Nellore rural (M)) to 13.44 per cent (Kothapalem, T.P gudur (M)), NLR3449 variety ranging from 9.81 per cent (Kothakaluva, Nellore rural (M)) to 13.32 per cent (Labur-1, Indukur peta (M)) whereas disease severity in NLR3354 variety was observed only in varigunda bit (12.77%) of T.P gudur(M) and NLR3396 variety in Akuthota (10.35%) of Nellore rural (M).

In Chittoor district, disease severity in ADT 37 variety ranged from 6.11 per cent in Narasingapuram village to 12.36 per cent in Reddivaripalli, village of Chandragiri (M) and MTU1010 variety had disease severity 8.14% in Athur, 9.29% in Ammavaripatnam of Renigunta (M).

During survey both Chittoor and Nellore districts clay loam soils were the predominant type of soil for rice cultivated.

Similarly, Reddy *et al.* (2018) carried out survey for the assessment of sheath blight severity in rice in nine districts of Telangana state. In Adilabad district the maximum severity (9scale) was observed Huzurnagar and Miryalaguda villages. The disease was observed from panicle initiation to grain hardening stage. Whereas some other workers were found different growth stages susceptible for infection. Shahjahan *et al.* (1990) reported panicle initiation to booting stage is most susceptible stage for sheath blight infection. Pal *et al.*, (2016) also found grain filling stage as most susceptible for sheath blight disease to occur.

Similar results were also recorded by Kapse *et al.* (2012) and Pal *et al.* (2015) plant variety is the major factors influencing sheath blight disease. Pratiwi *et al.* (2021) reported disease severity on rice plants in Northern Sumatra, Indonesia. Highest disease incidence (99.48%) and the highest disease severity (12.38%) was recorded Sumber tani and Talawi in Batubara district.

Isolation of pathogen *R. solani*

The sheath blight pathogen was isolated from diseased samples collected during the survey and isolated by tissue segment method (Rangaswami and Mahadevan, 1999) Then purified by single hyphal tip method and were identified as *R. solani* based on morphological characters using the descriptions given by Banniza, 1996.

In PDA at 28±1°C the culture was obtained in 3

days of incubation, light brown in colour and occupying the entire Petriplate (Plate 2.2a). Pathogen produced dark brown, irregular, loose type of sclerotial bodies on the PDA (Plate 2.2b, 2.2c). Microscopic examination of the fungal culture revealed broad brown coloured hyphae branching at right angles (Plate 2.2d). These observations were in accordance with Sneh *et al.*, 1991 who described hyphal branching at right angle, constriction at the point of branching of the mycelium and presence of a septum near the branching junction.

A roving survey was conducted during, *rabi*, 2020-2021 in Chittoor and Nellore districts of Andhra Pradesh to assess the disease severity of sheath blight disease in rice. In Nellore district, highest disease severity (13.44%) was recorded in Kothapalem of T.P Gudur mandal whereas the least disease severity was observed in Narasingapuram (6.11%) of Chandragiri mandal. The per cent disease incidence recorded in each variety varied depending on the place of cultivation disease severity during the panicle initiation stage varied from 6.11 to 13.44 per cent, whereas during the grain filling and harvesting stages it ranged from 8.33 to 13.32 per cent and 8.14 to 12.36 per cent respectively. When compared to all the cultivars, maximum disease severity was recorded with MTU-1010 variety at Kothapalem (13.44%) of T.P gudur mandal, Nellore district and ADT 37 variety had recorded minimum disease severity of 6.11% in Narasingapuram of Chandragiri mandal, Chittoor district.

Rice sheath blight pathogen *Rhizoctonia solani* was isolated from the diseased samples obtained from during survey. Pathogenicity of *R. solani* was conducted in pots containing rice seedlings at maximum tillering stage by mycelial balls insertion technique.

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