The Pharma Innovation Journal 2022; SP-11(9): 598-600

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(9): 598-600

www.thepharmajournal.com
Received: 09-06-2022
Accepted: 13-07-2022

Arvınd M
Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Prashanthi SK
Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Raghunandana A
Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Arvınd M
Department of Plant Pathology, University of Agricultural Sciences, Dharwad, Karnataka, India

Analysis of sheath blight inoculation techniques

Arvınd M, Prashanthi SK and Raghunandana A

Abstract
Sheath blight is a major fungal disease of rice caused by *Rhizoctonia solani* Kuhn. In this study, we checked the efficiency of major sheath blight inoculation technique *i.e*, agar block method on resistant and susceptible checks of sheath blight, Tetep and BPT-5204, respectively. The observations such as days to first appearance of symptoms and relative lesion height were taken at 21st post inoculation onto the checks. It was observed that the agar block method took four days to produce first visible symptom on BPT-5204 and five days on Tetep. The symptoms were more severe and scattered on BPT-5204 compared to the Tetep. Compared to other inoculation techniques agar block method was easier and took lesser time. Thus, the agar block method is one of the best inoculation technique in case of sheath blight of rice.

Keywords: Sheath blight of rice, *Rhizoctonia solani* Kuhn, agar block, symptoms, relative lesion height

Introduction
Rice is a major cereal crop over which more than half of the world's population is dependent (Khush, 2005) [6]. More than half of the world's rice is produced from the three countries namely China, India and Indonesia (Statista, 2021) [11]. Due to the increasing world population, the global demand for rice has increased. This situation is complicated by the losses caused due to biotic and abiotic stress among which the fungal disease namely sheath blight of rice (ShB) is predominant.

Sheath blight is the second most destructive fungal after rice blast. The yield loss due to this disease varies from negligible to 69 per cent depending upon disease severity, crop stage affected and environmental conditions (Sivalingam *et al*., 2006) [10]. It is caused by *Rhizoctonia solani* Kuhn which was first reported from Japan in 1910 (Miyake, 1910) [7]. The symptom consist of oval to elongated shaped greyish lesions with brown margin on leaf sheath (Wu *et al*., 2012) [14].

Development of resistant varieties is the best way of managing this disaease. Till now, no major highly resistant variety has been identified. Identification of resistant variety needs a proper inoculation technique which minimizes of effect of environment and produces maximum disease incidence. Several inoculation techniques have been reported such as colonized typha bit inoculation (Bhaktavatsalam *et al*., 1978) [1], syringe inoculation (Wasano *et al*., 1983) [13], bamboo-toothpick inoculation (Zou *et al*., 2000) [16], sclerotial inoculation (Singh *et al*., 2001) [9], rice straw inoculation (Che *et al*., 2003) [2] and agar block method (Jia *et al*., 2007) [5]. Each technique has it own advantage and disadvantage. Among these techniques, agar block method is most efficient and more commonly used. Thus, we tried to evaluate the efficiency of this technique on commonly used resistant and susceptible check, Tetep and BPT-204 respectively.

Materials and Methods
The present investigation was carried out in the greenhouse facility at Department of Plant Pathology, University of Agricultural Sciences (UAS), Dharwad, Karnataka, India.

Sowing of plant material
The seeds of rice variety BPT-5204 and Tetep were sown in earthen pots containing autoclaved soil and recommended dosage of fertilizer was applied. The rice plants were inoculated against RS4 isolate of *Rhizoctonia solani* Kuhn (GenBank Accession No MK213724) (Suryawanshi *et al*., 2020) [12].

Agar block method

For agar block method, pure culture of RS4 was maintained on fresh potato dextrose agar (PDA) medium in petriplates and incubated at room temperature (28-30 °C) for ten days. The ten days old culture was used for inoculation purpose at the 45th DAS. The sheath portion was opened and agar block containing mycelia and sclerotia was placed using forceps. The inoculated portion was covered with wet cotton and aluminium foil to induce maximum disease (Jia *et al*., 2007) [5].

Observations

The disease reaction against *Rhizoctonia solani* infection was measured in terms of relative lesion height percentage (RLH %) on 21st day post inoculation (dpi) for both the checks. RLH percentage was calculated using the following formula:

$$\text{RLH (\%)} = \frac{\text{Height of ShB lesion on plants (cm)}}{\text{Height of Plant (cm)}} \times 100$$

The scoring was done according to Standard Evaluation System (SES) grade scale (IRRI, 2002) [4]. The analysis of variance of RLH percentage was performed using Microsoft Excel.

Result and Discussion

The method of inoculation plays an important role in sheath blight disease screening (Park *et al*., 2008) [8]. In this study, the evaluation of agar block ShB inoculation technique was carried out on BPT-5204 and Tetep. The agar block method took four days to produce symptom on BPT-5204 and five day in case of Tetep after inoculation (Table 1). The lesions were oval to oblong shaped. In case of BPT-5204, leaf sheath as well as leaves was infected whereas, in moderately resistant check Tetep, only sheath portion had symptoms (Fig. 1A, 1B). The average lesion height and RLH % on 21 dpi was higher in case of BPT-5204 compared to Tetep (Table 1). The RLH percentage was above 66 per cent in case of BPT-5204 which represents highly susceptible (HS) disease reaction with a disease grade 9.0 whereas, the RLH percentage of tetep was in between 21-30 per cent depicting its moderately resistant nature as per standard evaluation system (SES) (IRRI, 2002) [4]. The values of RLH was on par with the RLH per cent obtained by Hossain *et al*. (2014) [3] and Yadav *et al*. (2015) [15].

Table 1: Observations recorded on 21st Days Post Inoculation

Variety	First visible symptom on (dpi)	Lesion Height (cm)	Plant Height (cm)	RLH %	Grade	Disease Reaction
BPT-5024	4th	25.30	25.80	98.06	9	HS
Tetep	5th	8.40	33.1	25.38	3	MR
CD		0.593	1.083	1.961		
SE(m)		0.147	0.269	0.486		
CV%		1.513	1.573	1.365		

* Lesion height and plant height recorded in this study are average of three replications

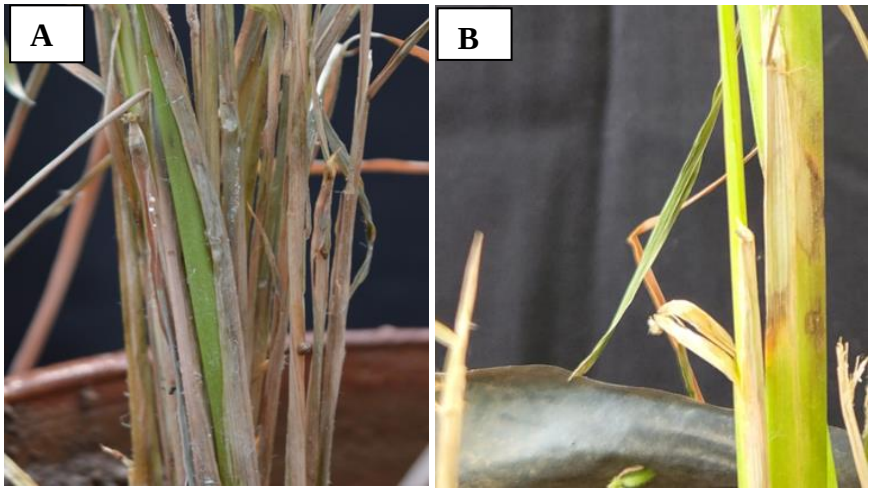

Fig 1: Symptoms observed on A) BPT-5204 (Susceptible check) and B) Tetep (Moderately Resistant Check) after inoculating with RS4 isolate of *Rhizoctonia solani* on 21st dpi by agar block method

Conclusion

Identification of resistant varieties is the most economical way of managing the rice sheath blight disease. Hence, effective inoculation methods need to be found for correct screening of available germplasm against ShB. The rice sheath inoculation with agar block along with sclerotia has been proven to be the most efficient, consistent and reproducible methods of rice sheath blight disease inoculation under field and artificial conditions. Other methods such as typha and bamboo inoculation are region specific and cannot be used where typha and bamboo are not available. Agar block method is also more economical compared to syringae, tooth pick and other methods.

Statements and Declarations

Conflict of interest: The authors declare that they have no conflict of interest.

References

1. Bhaktavatsalam G, Satyanarayana K, Reddy APK, John VT. Evaluation for sheath blight resistance in rice. Int Rice Research Newsletter International Rice Research Institute, Manila, Philippines, 1978
2. Che K, Zhan Q, Wang Z, *et al*. Tagging and mapping of rice sheath blight resistant gene. Theorotical and Applied Genetics. 2003;106:293-297.
3. Hossain MK, Tze OS, Nadarajah K, Jena K, Rahman

Bhuiyan MA, Ratnam W. Identification and validation of sheath blight resistance in rice (*Oryza sativa* L.) cultivars against *Rhizoctonia solani*. Canadian Journal of Plant Pathology. 2014;36(4):482-490.
4. IRRI. Standard Evaluation System for Rice, International Rice Research Institute, Manila, Philippines; c2002. p. 56.
5. Jia Y, Correa-Victoria F, McClung A, *et al*. Rapid determination of rice cultivar responses to the sheath blight pathogen *Rhizoctonia solani* using a micro-chamber screening method. Plant Disease. 2007;91(5):485-489.
6. Khush GS. What It Will Take to Feed 5.0 Billion Rice Consumers in 2030. Plant Molecular Biology. 2005;59(1):1-6.
7. Miyake I. Studienuber die Pilze der Reispflanze in Japan. Journal of College of Agriculture, Imperial University, Tokyo. 1910;2:237-276.
8. Park DS, Sayler RJ, Hong YG, Nam MH, Yang Y. A method for inoculation and evaluation of rice sheath blight disease. Plant Disease. 2008;92:25-29.
9. Singh A, Rohila R, Singh US, Savary S, Willocquet L, Duveiller E. An improved inoculation technique for sheath blight of rice caused by *Rhizoctonia solani*. Canadian Journal of Plant Pathology. 2001;24:65-68.
10. Sivalingam PN, Vishwakarma SN, Singh US. Role of seed-borne inoculum of *Rhizoctonia solani* in sheath blight of rice. Indian Phytopathology. 2006;59:445-452.
11. Statista. Rice - Statistics & Facts 2020-2021, 2021. https://www.statista.com/topics/1443/rice (Last accessed on 28 August, 2022).
12. Suryawanshi PP, Krishnaraj PU, Suryawanshi MP. Evaluation of actinobacteria for biocontrol of sheath blight in rice. Journal of Pharmacognosy and Phytochemistry. 2020;9:371-376.
13. Wasano K, Hirota Y. Varietal differences in the resistance to sheath blight disease caused by *Rhizoctonia solani* Kuhn, by the syringe inoculation methods. Bulletins of the Faculty of Agriculture of Saga University 1983;60:49-59.
14. Wu W, Huang J, Cui K, Nie L, Wang Q, Yang F, Sheath blight reduces stem breaking resistance and increases lodging susceptibility of rice plants. Field Crops Research. 2012;128:101-108.
15. Yadav S, Kumar RR, Anuradha G, Reddy VLN, Sudhakar R. Screening of rice germplasms for sheath blight resistance and assessment of parental polymorphism using SSR markers. Ecology Environment and Conservation. 2015;21:295-301.
16. Zou JH, Pan XB, Chen ZX, Xu JY, Lu JF, Zhai WX, *et al*. Mapping quantitative trait loci controlling sheath blight resistance in two rice cultivars (*Oryza sativa* L.). Theorotical and Applied Genetics. 2000;101:569-573.