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SHORT COMMUNICATION

Antagonistic potential of endophytic bacteria from *Pokkali*rice against *Rhizoctonia solani* causing sheath blight

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Rice (*Oryza sativa* L.), an essential cereal crop, faces severe yield losses due to sheath blight caused by *Rhizoctonia solani.* The present study screened endophytic bacteria isolated from the roots, stems, and leaves of Pokkali rice for antagonistic activity against *R. solani* based on dual-culture assays. Among these, PTSE7 and KMRE4 exhibited the highest mycelial growth inhibition at 82.88% and 72.41% respectively, while other isolates showed varying levels of antifungal activity. These findings suggest that Pokkali rice has some promising endophytes with antimicrobial activity against *R. solani*. The two most promising isolates will be characterized for metabolite production and their efficacy in sheath blight management will be assessed *in vivo.*

Keywords : Antifungal activity, endophytic bacteria, Pokkali rice, *Rhizoctonia solani*, sheath blight

INTRODUCTION

Rice (*Oryza sativa* L.) stands as one of the most significant cereal crops globally; however, its production is significantly hindered by sheath blight caused by *Rhizoctonia solani* Kuhn, a necrotrophic fungus known to have a broad host range and longevity in the soil. Conventional control measures rely almost completely on fungicide applications, which increase production costs and raise environmental and human health concerns. Finding eco-friendly alternatives has recently attracted attention to beneficial microbes, especially endophytic bacteria, which are microbes residing in plant tissues, that cause little to no observable symptom expression in the host plant, and ultimately serve as valuable symbionts important to produce new solutions for several agricultural problems.

These microbes inhabit the interior tissues of roots, shoots and leaves of the host plant, play an active role in nutrient assimilation and can induce the production of various secondary metabolites that can provide defenseagainst pathogens (Shah *et al.* 2021). Root-associated endophytic bacteria can exhibit antagonistic activity against fungal phytopathogens through a variety of mechanisms contributing to plant health and competitiveness (Maqsood *et al.,* 2020).

Pokkali is a traditional rice variety that is endemic to the saline coastal areas of Kerala. It is known to have some resilience against abiotic and biotic stresses, potentially due to the types of microbiota that it associates with. Numerous studies have demonstrated that the rhizosphere and endosphere of Pokkali rice contain bacteria with potential for nitrogen fixation, phosphate solubilization, and the potential to produce antifungal compounds. This rich array of the microbiome contributes to the extreme resilience of Pokkali plants and may provide a resource for discovering new microbial strains with potential opportunities for sustainable management of field crops and soil health enhancement. However, there is limited information on the antagonistic activity of endophytic bacteria from Pokkali rice against *R. solani.* Therefore, the present study was undertaken to evaluate the antagonistic

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Table 1 : Antagonistic activity of endophytic bacterial isolates from Pokkaliriceagainst*R. solaniin* dual culture assay

Isolate	Percent mycelial growth inhibition	Isolate	Percent mycelial growth inhibition
NLSE6	39.63 ± 3.20^{bc} (0.68)	KMLE5	35.74 ± 2.25^{de} (0.64)
NLRE2	37.22 ± 1.67^{c} (0.66)	PTRE5	30.00 ± 0.96^{e} (0.58)
NLSE2	37.59 ± 1.40^{c} (0.66)	PTRE3	38.52 ± 4.66^{b} (0.67)
NLSE4	48.33 ± 4.55^{a} (0.77)	PTRE6	37.59 ± 1.28^{bc} (0.66)
NLLE2	43.70 ± 00.85^{b} (0.72)	PTSE6	34.44 ± 0.56^{cd} (0.63)
KMLE6	39.63 ± 1.70^{cd} (0.68)	PTSE3	34.82 ± 0.85^{cd} (0.63)
KMLE1	38.20 ± 4.34^{cde} (0.67)	PTSE7	82.88 ± 3.21^{a} (1.15)
KMLE3	34.44 ± 0.56^{e} (0.63)	PTLE6	32.16 ± 1.50^{de} (0.60)
KMLE4	38.33 ± 2.23^{cde} (0.67)	PTLE3	30.57 ± 0.54^{e} (0.59)
KMLE7	42.00 ± 3.46^{c} (0.70)	PTLE5	37.07 ± 0.64^{bc} (0.65)
KMRE4	72.41 ± 5.46^{a} (1.02)	PTLE4	30.92 ± 2.10^{e} (0.59)
KMRE5	51.11 ± 0.56^{b} (0.80)	Control	0.00 ± 0.00^{f} (0.09)

* Mean (± SD) of three replications. Values followed by similar superscripts in a column are not significantly different at 5% level (p d" 0.05).
**CD and SE(m) are calculated separately for each location: Njarakkal (CD 0.044, SE(m) 0.014), Kalamassery (CD 0.052, SE(m) 0.018), Palluruthy (CD 0.037, SE(m) 0.013)

potential of endophytic bacterial isolates from Pokkali rice using a dual culture assay.

MATERIALS AND METHODS

The antagonistic activity of endophytic bacteria from Pokkali rice against *R. solani* was studied utilizing a dual culture plate assay (Anith *et al.* 2021). Rice plants were collected from three Pokkali padasekharams, namely Kalamassery, Njarakkal and Palluruthy blocks (AEU 5) in the Ernakulam district, Kerala. Endophytic bacterial isolates were purified by streaking onto nutrient agar. A five-day old mycelial disc of *R. solani* (diameter, 6 mm) was placed in the center of potato dextrose agar (PDA) plates. Two streaks of the test bacterial isolate (2 cm each) were made on both edges of the plate. A plate with the pathogen alone was used as the control. All plates were incubated at 28°C for two days. Radial mycelial growth was measured and percentage inhibition of mycelial growth and any inhibition zone (mm) were recorded.

RESULTS AND DISCUSSION

The findings of antagonism assessment of endophytic bacteria from Pokkali rice against *R. solani* through dual culture assay are shown below in (Table 1). The isolates were assigned

codes NLRE (Njarakkal Root Endophyte), NLSE (Njarakkal Stem Endophyte), NLLE (Njarakkal Leaf Endophyte), KMRE (Kalamassery Root Endophyte), KMLE (Kalamassery Leaf Endophyte), PTRE (Palluruthy Root Endophyte), PTSE (Palluruthy Stem Endophyte), and PTLE (Palluruthy Leaf Endophyte) according to the plant part and origin site of the isolates. Of the Njarakkal isolates, NLSE4 showed the highest inhibition of mycelial growth (48.33%), followed by NLLE2 with 43.70%, while the lowest inhibition was recorded by NLRE2 (37.22%). Among the Kalamassery isolates, KMRE4 had the maximum inhibition (72.41%) and KMRE5 showed 51.11% inhibition indicating strong antagonistic. However, KMLE3 and KMLE5, which showed inhibition below 36%, were comparatively less effective. For Palluruthy, PTSE7 showed the maximum inhibition with 82.88%, followed by PTRE3 (38.52%), while PTRE5 and PTLE4 had the lowest activity, each showing about 30% inhibition.

The substantial variation in antagonistic activity among isolates indicates diversity in their pathogen suppression mechanism by antifungal metabolite production or through hydrolytic enzyme productionor by competing for nutrients and space. The strong inhibition displayed by isolates such as PTSE7 and KMRE4 indicates their potential as biocontrol agents against the sheath blight pathogen. Nagendran *et al*. (2014) and Siva *et al.* (2024) also noted similar results and highlight that endophytic bacteria can hinder the growth of fungal pathogens, especially *R. solani,* through the production of bioactive compounds and cell-wall degrading enzymes.

Overall, the results of this preliminary screening show that Pokkali rice has endophytic bacteria with noteworthy antifungal properties. In particular, isolates PTSE7 and KMRE4 show promise for further metabolite characterization and *in vivo* testing for sheath blight disease in rice.

DECLARATION

Conflict of Interest. Authors declare no conflict of interest.

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