Marker-assisted introgression of two major blast resistance genes into Warangal Samba (WGL-14), popular rice variety

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Abstract

Introduction

Warangal Samba (WGL-14) is a high yielding, popular variety of rice with 135-140 days duration, recently recognised as a national check for medium slender grain type and tolerant to Rice Tungro Virus (RTV). However, Warangal Samba is highly susceptible to blast disease, which limits rice yields significantly. In order to improve Warangal Samba for blast resistance, two major blast resistant genes (*Pi1* and *Pi54*) were introgressed through Marker Assisted Backcross Breeding.

Methodology

NLR 145 possessing *Pi1* and *Pi54* genes in homozygous condition was used as donor parent for blast resistance and backcross breeding strategy was adopted for targeted introgression of the resistance genes. PCR based molecular markers RM224 and Pi54MAS, which are tightly linked to *Pi1* and *Pi54* respectively, were used for foreground selection, while 123 rice microsatellite markers polymorphic between the donor and recurrent parent were used to identify the best backcross plants which not only possess the two target genes, but also have maximum recovery of recurrent parent genome at each generation.

Results and Discussion

The F_1s generated from the cross, Warangal Samba/NLR 145 were screened for presence of the target resistance genes *Pi1* and *Pi54* using the gene-linked molecular markers RM224 and Pi54MAS, respectively to identify the 'true' F_1s showing heterozygous amplification pattern. Out of 125 F_1s, eight plants were observed to possess both the target resistance genes, i.e. *Pi1* and *Pi54* in heterozygous condition and these were then used as male parent and backcrossed to Warangal Samba to generate BC_1F_1 plants. Out of 396 BC_1F_1 plants, a total of 202 were

identified to be positive for *Pi1*, 187 were positive for *Pi54* and 18 were identified to be double positive for both *Pi1* and *Pi54* genes using the gene-linked markers. The 18 double positive plants were then subjected for background selection using 123 parental polymorphic SSR markers and a single 'positive' BC_1F_1 plant # SB27 possessing maximum recovery of recurrent parent genome (73%) was selected and then backcrossed with Warangal Samba to generate BC_2F_1 plants. A similar marker-assisted selection procedure was followed for selection of BC_2F_1 and BC_3F_1 plants. The selected double positive BC_3F_1 plants were then subjected to background selection and a single 'positive' BC_3F_1 plant # SB27-11-9 possessing maximum recovery of recurrent parent genome (98.6%) was selected and selfed to generate BC_3F_2 plants. The identified BC_3F_2 plant (i.e. SB27-11-9) was then advanced to BC_3F_3, BC_3F_4 and BC_3F_5 generations based on pedigree based selections. At BC_3F_5 generation five backcross derived lines (*i.e.*, WGL-1463, WGL-1465, WGL-1470, WGL-1472 and WGL-1475) possessing resistance against blast, high yield, medium slender grain type and with recurrent parent genome recovery ranging from 88.8 % to 98.6 % were selected and advanced for further evaluation.

Conclusion

This work demonstrates the successful application of molecular-marker technology coupled with phenotype based selection for targeted introgression of two major blast stress resistance genes and superior grain quality into popular rice variety.

Keywords: rice, Warangal Samba, blast resistance, marker-assisted selection