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MARKER ASSISTED BREEDING FOR DEVELOPMENT OF BACTERIAL BLIGHT AND BLAST RESISTANT BASMATI RICE VARIETIES

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Purpose:
Pusa Basmati 1121 and Pusa Basmati 6 are the most popular Basmati rice varieties covering more than 75% of the total Basmati rice area in India. PB1121 possess exceptional cooked kernel length while Pusa Basmati 6, a semi-dwarf, superior quality Basmati rice variety produces non-chalky grains, with excellent cooking quality and aroma. However, these cultivars are highly susceptible to bacterial blight (BB) caused by *Xanthomonas oryzae pv*. *oryzae* and blast disease caused by *Magnaporthe oryzae*, which affect both yield as well as grain quality.

Approach and methods used:
Marker assisted simultaneous but step-wise backcross breeding was adopted to incorporate the BB resistance genes, *xa13* and *Xa21* from an elite donor Improved Pusa Basmati 1 and an *O. nivara* derived novel BB resistance gene, *Xa38* from PR114-*Xa38* into PB1121 and PB6. The blast resistance genes, *Piz5* and *Pi54* were sourced from the donors, Pusa1602 and Pusa1603, respectively. The BC_3F_1s carrying individual blast resistance genes were inter-crossed followed by marker assisted pedigree selection to develop the pyramids, carrying *Piz5* and *Pi54* in the genetic background of PB1121 and PB 6. Gene linked markers were used for foreground selection followed by rigorous phenotypic and background selection to recover recurrent parent genome and phenome.

Key results:
Marker assisted backcross breeding in combination with stringent phenotypic selection helped in the development of PB1121+*xa13*+*Xa21*, PB1121+*Xa38*, PB1121+*Pi2*+*Pi54*, PB6+*xa13*+*Xa21*, PB6+*Pi2*+*Pi54* with RPG recovery ranging from of 93.5 % to 97.7%, estimated using a minimum of 60 polymorphic SSR markers providing genome wide coverage. Further, PB1121+*xa13*+*Xa21*, PB1121+*Xa38*, PB6+*xa13*+*Xa21*were found to be highly resistant against the most virulent BB isolates from Basmati growing areas. Similarly, PB1121+*Pi2*+*Pi54* and PB6+*Pi2*+*Pi54* exhibited resistance to blast disease under artificial inoculation with respective diagnostic isolates and were also resistant under natural epiphytotics in the uniform blast nursery at Malan and Hazaribag. Improved lines were on par with the recurrent parents for agronomic and cooking quality traits.

Synthesis and Applications:
These improved lines will help in managing BB and blast along with the reduction in the cost of cultivation as well as better grain quality due to less pesticide usage. Further, these lines are invaluable sources for disease resistance genes in Basmati rice improvement program.