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Contribution of RAPD markers for the accumulation of total silicon in various plant parts of aerobic rice (*Oryza sativa* L.)

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Silicon is a major constituent of plant tissues, although not considered to be an essential nutrient, present in consistently high amounts in the terrestrial plants. Silicon has been found to be associated with various abiotic and biotic stress resistance mechanisms especially drought and blast disease in rice. A significant amount of variation was observed in the accumulation of silicon among 85 diverse rice genotypes under study in leaves at flowering and maturity stage as well as in rice grains. A set of 74 RAPD markers that were polymorphic across the 85 diverse genotypes were scored. Single marker analysis (SMA) and stepwise multiple regression analysis (SMRA) was used to determine the extent of markers associated with silicon accumulation in rice. Among the various RAPD markers, SMA established association of four RAPD markers among which $OPC14_{1900}$ alone contributes to 3.89% while in SMRA, $OPD8_{1000}$ and $OPC14_{1900}$ showed more than 11% contribution for silicon accumulation in leaves at flowering stage. For the accumulation of silicon in leaves at maturity stage, SMA established association of five RAPD among which $OPD9_{1400}$ contributing 5.71% and SMRA revealed $OPD9_{1400}$ contributing 6.74%. In SMA, $OPE7_{1900}$, $OPE1_{700}$ and $OPB8_{1250}$ contributed more than 18% towards silicon accumulation in rice grains. Taken together, our result suggests the existence of genotypic variation in silicon accumulation in rice genotypes and is also developmentally regulated and the markers identified here could be validated and used to determine their linkages with these traits on a segregating populations.

Key words : Silicon, Aerobic rice, RAPD markers.

INTRODUCTION

Rice is a symbol of cultural identity and global unity and is the world's most popular food. One of the major challenges for agriculture is to produce more food with less water. Rice is being mainly grown in submerged conditions. Moisture stress is the single most important factor limiting rice productivity in the rain fed habitats. However, there is a need to develop strategies for growing rice under aerobic conditions, which limit the use of water in rice production and to enhance the production of rice per unit volume of water consumed (Bouman and Tuong, 2001). However, to make the concept of "aerobic rice" successful, the existing genotypes needs to evaluated as well as demands the development of new varieties that are responsive to inputs (water, nutrients) to reach high yields under non-flooded conditions (Bouman *et al.*, 2002).

Silicon a micronutrient, is the second most abundant element in the earth's crust after oxygen (Bond and McAuliffe, 2003) It is found to enhance photosynthesis, positive effect on growth and yield, impart resistance to water stress, lodging, diseases and abiotic stress like salinity, drought, and protection against temperature extremes (Epstein, 2001). It was believed that silicon accumulation in the cell wall prevents the pathogen entry, however recent studies suggest that silicon stimulates the expression of disease resistance genes in dicots (Fawe *et al.*, 2001). Silicon reduces the severity levels of diseases including blast, brown spot, sheath blight, leaf scald and grain discoloration (Seebold *et al.*, 2000). Silicon stimulates the production of phenolic compounds and/or phytoalexins, which play a primary role in the defense response against rice blast infection (Rodrigues *et al.*, 2003).

Molecular markers commonly referred to as DNA markers, show Mendelian inheritance, stably inherited, without pleiotropic effect and are unaffected by the environment or developmental stages. Marker assisted selection, gene pyramiding, QTL (Quantitative trait loci) mapping, targeted map based cloning of important genes, introgression of exotic germplasm, DNA fingerprinting of crops for detecting the markers associated with various traits are being commonly used in crop improvement program. Ma *et al.* (2004) by using microsatellites and expressed sequence tag (EST)-based PCR markers showed that silicon transporter gene is localized on chromosome 2 flanked by microsatellite marker RM5303 and expressed sequence tag-based PCR marker, E60168. In the present study, we evaluated 85 diverse rice

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