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Identification and characterization of mutations in genes involved in GA₃ biosynthesis and signaling pathways of a white seeded dwarf rice variety

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Abstract

Rice is one of the major cereals in the world and many African and Asia countries consume rice as a staple food, including Sri Lanka. However, the existing rice yield is not enough to fulfil the requirement. Because a considerable amount of yield lost has been reported every season due to the lodging of the rice plants. Therefore, several breeding programs have been conducted to incorporate the traits responsible for lodging resistance in rice. Dwarfism in rice is one such characteristic to develop lodging resistant varieties. Changes in the genetic material of rice are responsible for dwarfism, including genetic mutations and involvement of plant hormones. Since gibberellic acid involves different developmental processes in plants, mutations in gibberellic acid biosynthesis and signalling pathways are considered as the major reasons for dwarfism. This study is based on a white seeded dwarf rice variety which was found among the progeny of CIC *Tikiri*. A comprehensive study was conducted to find the causes of dwarfism based on the involvement of gibberellic acid in dwarfism. Mutations were identified using a genetic identification process through PCR amplification, and DNA sequence alignment of selected genes. PCR amplification was done using *OsGA3ox2* and *OsSLR1* primers, targeting the genes that produce key components in the gibberellic acid biosynthesis and signalling pathways; GIBBERELLIN 3BETA-HYDROXYLASE 2 and DELLA genes, respectively. The amplified regions were aligned, and a base pair comparison was done to identify the mutations in the respective regions. When compared with the mother plant "CIC *Tikiri*" species, certain changes within the sequences have been observed. These changes cause the gain of different amino acid sequences in DELLA and GIBBERELLIN 3BETA-HYDROXYLASE 2. As a result, the functions of these proteins are altered. These changes might cause dwarfism in the white seeded dwarf rice variety. However, phenotypic identification using a hormonal assay needs to verify the involvement of gibberellic acid in dwarfism of the white dwarf rice variety.

Keywords: DELLA protein, dwarfism, gibberellin, high-yield rice varieties, OsSLR1, OsGA3ox2

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