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Identification and characterization of mutations in genes involved in GA_3 biosynthesis and signaling pathways of a black seeded dwarf rice variety

I.L. Jayasekara[1*], D.S. de Z Abeysiriwardena[2] and M.P.C.S. Dhanapala[1]

[1] Department of Molecular Biology and Biotechnology, Faculty of Science, University of Peradeniya, Sri Lanka
[2] CIC Agri Businesses, Pelwehera, Dambulla, Sri Lanka

Abstract
Gibberellic acids (GA) are a family of tetracyclic diterpenoid phytohormones, whose regulation of biosynthesis and signal transduction are crucial for key characteristics in plant growth and development. Plants that lack these elements exhibit unique phenotypes, including delayed germination, dwarfism, small and dark green leaves, and retarded root development. Dwarfism, in particular, is a desirable trait in crop breeding, as it enhances the plant's ability to withstand lodging damage caused by heavy rain and wind, resulting in increased yields. Rice is a major crop plant grown worldwide including in Sri Lanka. Similar to all the other plant types, gibberellic acids play a prominent role in dwarfism in rice. Hence, this research was carried out to study the involvement of a few genes in GA biosynthesis and signaling pathways on the dwarfism of black seeded dwarf rice variety. Therefore, this study was conducted to identify and characterize mutations responsible for the dwarf phenotype of a novel black seeded dwarf rice variety which is a spontaneous breeding outcome of a locally available rice variety CIC *Tikiri.* A genetic analysis was performed through DNA extraction and Polymerase Chain Reaction using two selected molecular markers, *OsSLR1* and *OsGA3ox2*. They are accountable for amplifying segments of *SLR1* and *GA3ox2* genes in the rice genome, which encode for the production of DELLA protein and GIBBERELLIN 3BETA-HYDROXYLASE 2, which are critical in the conductance of gibberellic acid signaling and biosynthesis pathways, respectively. This process was followed by a sequence alignment with the associated mother plant variety, CIC *Tikiri*. The results revealed some variations of a few base pairs in the amplified regions of the genes. The differences that appeared to be nonsense mutations and INDELs could be concluded as possible causes of dwarfism of the considered mutant rice variety. However, a phenotypic analysis through a gibberellic acid hormonal treatment assay is recommended to further clarify the involvement of the identified mutations for the respective phenotype.

Keywords: DELLA, Dwarfism, Gibberellic acid biosynthesis, Gibberellic acid signaling, *Oryza sativa*

Corresponding Author: il.jayasekara97@gmail.com