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Hee-Jong Koh et al., J Plant Physiol Pathol 2017, 5:5
DOI: 10.4172/2329-955X-C1-011

3rd Global Summit on

Plant Science

August 07-09, 2017 | Rome, Italy

Complementary interaction of two starch biosynthesis genes confers a mild sugary endosperm in rice

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Starch biosynthesis is one of the most important pathways that determine both grain quality and yield in rice (*Oryza sativa L.*). Sugary endosperm, sugary-1 (sug-1), is a mutant trait for starch biosynthesis. Plants carrying sug-1 produce grains that accumulate water-soluble carbohydrates instead of starch, even after maturity. Although this trait confers improved digestibility and enhanced nutritional merits, sugary endosperm rice has not been commercialized due to severely wrinkled grains and subsequent problems in milling. We performed chemical mutagenesis on the Korean *japonica* cultivar Hwacheong, and identified a mild sugary mutant, sugary-h (sug-h). Grains of the sug-h mutant were translucent and amber-colored, and the endosperm appeared less wrinkled than sug-1, whereas the soluble sugar content was high. These characteristics confer greater marketability to the sug-h mutant through normal procedures in hulling and milling of rice grains. Genetic analyses indicated that the sug-h mutant phenotype was controlled by complementary interaction of two recessive genes, Isoamylase1 (OsISA1), which was reported previously and starch branching enzyme IIa (OsBEIIa), which was newly identified in this study. These results extend our knowledge of the mechanism of starch biosynthesis in rice endosperm and facilitate the breeding of sugary endosperm rice for better digestibility.

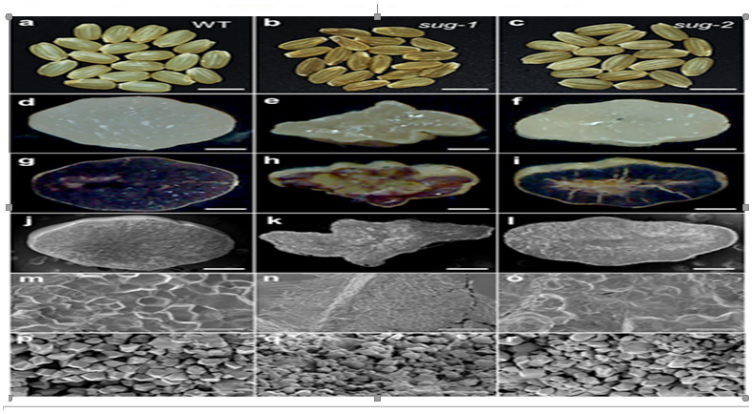

Figure 1: Optical and scanning electron microscopy observation of grain phenotype and starch granule structure in wild-type rice (Hwacheong) and sug-1 and sug-h mutants. (a-c) The sug-h mutant grain exhibits a phenotype that is intermediate between that of the wild type and sug-1. Bars=4 mm. (d-i) Cross sections of wild-type, sug-1, and sug-h kernels at the mature stage. Sectioned seeds were stained with iodine solution. Bars=0.5 mm. (j-o) SEM observations of wild-type, sug-1, and sug-h mutant endosperm. (j-l) Bars=0.5 mm. (m-o) Bars=10 μm. (p-r) SEM observations of starch granule structures in wild-type, sug-1, and sug-h mutant endosperm. Bars=10 μm.

Biography

Hee-Jong Koh has his expertise in rice genetics and breeding for higher yield and better quality. He has developed several mutants on morphological and quality traits and cloned genes responsible for the mutant phenotypes. He has also studied natural variation in yield-related and quality traits demonstrating selection models for better genotypes in rice breeding programs. Recently, he has edited a book "*Current Technologies in Plant Molecular Breeding*" published by Springer Verlag.

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