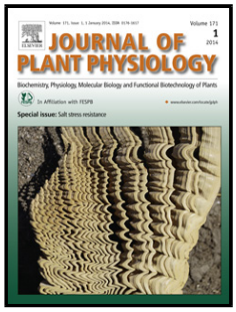

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PII: S0176-1617(18)30610-2
DOI: https://doi.org/10.1016/j.jplph.2018.09.005
Reference: JPLPH 52841

To appear in:

Received date: 2-3-2018
Revised date: 9-9-2018
Accepted date: 9-9-2018

Please cite this article as: Alamin M, Zeng D-Dong, Sultana MH, Qin R, Jin X-Li, Shi C-Hai, Rice *SDSFL1* plays a critical role in the regulation of plant structure through the control of different phytohormones and altered cell structure, *Journal of Plant Physiology* (2018), https://doi.org/10.1016/j.jplph.2018.09.005

Rice *SDSFL1* plays a critical role in the regulation of plant structure through the control of different phytohormones and altered cell structure

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Abstract

Semi-dwarfism is one of the most important agronomic traits for many cereal crops. In the present study, a mutant with *semi-dwarf and short flag leaf 1*, *sdsfl1*, was identified and characterized. The *sdsfl1* mutant demonstrated some distinguished structural alterations, including shorter plant height and flag leaf length, increased tiller numbers and flag leaf width, and decreased panicle length compared with those of wild type (WT). Genetic analysis suggested that the mutant traits were completely controlled by a single recessive gene. The *SDSFL1* gene was mapped to the long arm of chromosome 3 within a region of 44.6 kb between InDel markers A3P8.3 and A3P8.4. The DNA sequence analysis revealed that there was only a T to C substitution in the coding region of *LOC_Os03g63970*, resulting in the substitution of Tryptophan (Try) to Arginine (Arg) and encoding a GA 20 oxidase 1 protein of 372 amino acid residues. Photosynthesis analysis showed that the photosynthetic rate (Pn), stomatal conductance (Gs), and intercellular CO_2 concentration (Ci) were significantly increased in *sdsfl1*. Chlorophyll a (Chl a), total Chl, and carotenoid contents were significantly increased in *sdsfl1* compared with those in WT. *sdsfl1* carried a reduced level of GA_3 but reacted to exogenously applied gibberellins (GA). Moreover, the levels of abscisic acid (ABA), indole 3-acetic acid (IAA), and salicylic acid (SA) were notably improved in *sdsfl1*, whereas there was no noteworthy change in jasmonic acid (JA). The results thus offer a visible foundation for the molecular and physiological analysis of the *SDSFL1* gene, which might participate in various functional pathways for controlling plant height and leaf length in rice breeding.

Abbreviations: ABA, abscisic acid; Arg, arginine; bp, base pair; BR, brassinosteroid; Chl, chlorophyll; Ci, intracellular CO_2 concentration; EMS, ethylmethane sulfonate; GA, gibberellins; Gs, stomatal conductance; IAA, indole 3-acetic acid; InDel, insertion/deletion; kb, kilobase; PAC, paclobutrazol; Pn, photosynthetic rate; qRT-PCR, quantitative real-time polymerase chain reaction; SA, salicylic acid; *SDSFL1*, *Semi-Dwarf and Short Flag Leaf 1*; SEM, scanning electron microscope; SL, strigolactone; TEM, transmission electron microscopy; Tr, transpiration rate; Try, tryptophan; UTR, untranslated region.