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The maternally expressed polycomb group gene *OsEMF2a* is essential for the endosperm cellularization and imprinting in rice

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Abstract

Cellularization is a key event in endosperm development. Polycomb group (PcG) genes, such as *Fertilization-Independent Seed 2 (FIS2)*, are vital for the syncytium-to-cellularization transition in Arabidopsis plants. In this study, we found that *OsEMF2a*, a rice homolog of the Arabidopsis PcG gene *Embryonic Flower2 (EMF2)*, plays a similar role of *FIS2* in the aspect of seed development, although there are limited sequence similarities between the genes. Delayed cellularization was observed in *osemf2a* and associated with an unusual activation of type I MADS-box genes. The cell cycle was persistently activated in the *osemf2a* caryopses, which was likely caused by an overproduction of cytokinin. However, overaccumulation of auxin was not found to be associated with the delayed cellularization. As *OsEMF2a* is a maternally expressed gene in the endosperm, a paternally inherited functional allele was unable to recover the maternal defects of *OsEMF2a*. Many imprinted rice genes were deregulated in the defective hybrid seeds of *osemf2a* (♀)/9311 (♂) (m9). The paternal expression bias of some paternally expressed genes was disrupted in m9, due to either activation of maternal alleles or repression of paternal alleles. These findings suggest that *OsEMF2a*-PRC2-mediated H3K27me3 is necessary for the endosperm cellularization and genomic imprinting of rice.

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