SEED DEVELOPMENT

Surveillance of embryonic cuticle

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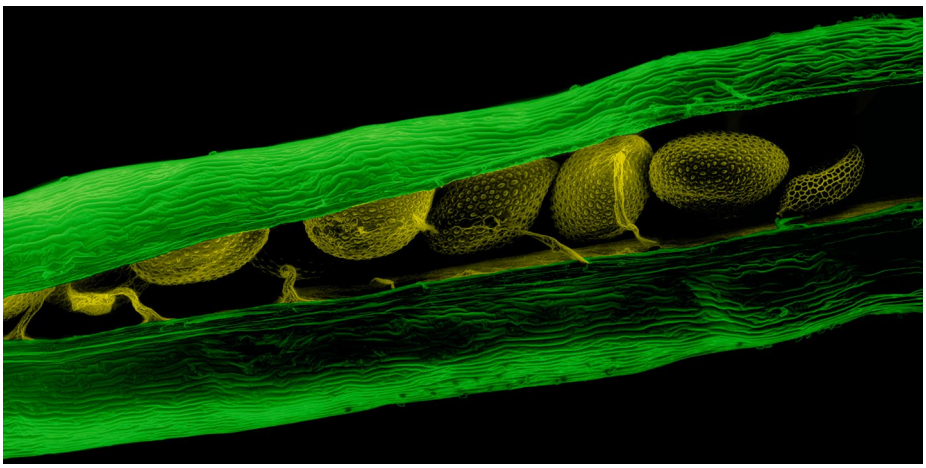

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The cuticles of plant epidermises protect internal cells against water loss and different external stresses in land plants. The synthesis of epidermal cuticles starts from the embryo stage and plays an important role in embryogenesis. It is believed that one protease, ABNORMAL LEAF SHAPE 1 (ALE1), and two membrane receptor kinases, GASSHO1 (GSO1) and GSO2, are essential to the formation of the embryonic cuticle as well as seed development. Recently, Gwyneth Ingram's group in the University of Lyon, France, and their collaborators found a new peptide ligand associated with GSO receptors, proposing a mechanism that involves bidirectional movement of the peptide between the embryo and endosperm to regulate cuticle deposition and seed development in *Arabidopsis*.

In a 2016 paper in *Plant Physiology*, Elisa Fiume et al. reported the identification of this small peptide, designated TWISTED SEED1 (TWS1), which is important in cuticle deposition, embryo development and plant growth. In this new study, Doll et al. hypothesized that TWS1 and GSOs were functionally relevant according to the phenotype similarity between their mutants. The C terminus of the TWS1 protein shared sequence similarity to certain regions of CASPARIAN STRIP INTEGRITY FACTORs (CIFs), which are known ligands of GSO1 and GSO2 that are not likely to be involved in regulating seed development. Genetic analysis is also in support to the proposed function of TWS1 in GSO-regulated seed development. More importantly, the authors have shown that sulfated TWS1 bound GSO1 in vitro and determined a dissociation constant of ~30 nM. In the *cif1 cif2* double mutant, exogenous application of TWS1 partially complemented the Casparian strip integrity phenotype, while the complementation effect is dependent on the presence of GSO1. In addition, they found that TWS1 is a substrate of ALE1 and requires C-terminal cleavage to be active. However, the expression patterns are distinct: ALE1 is exclusively expressed in the endosperm, while the TWS1 promoter is only active in the embryo. Therefore, they proposed that a bidirectional movement of TWS1 peptides between the embryo and endosperm is necessary for the processing and function of TWS1. Further transgenic analyses conducted by ectopically expressing ALE1 in the embryo or TWS1 in the endosperm suggest that the specific spatial localization of ALE1 and TWS1 and their communication may be indispensable in the signalling pathway determining seed development.

Although more mechanistic details of the proposed bidirectional dialogue remain to be determined, this work provides new insights on embryonic cuticle formation, embryo–endosperm communications, plant signalling and seed development.

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