1. 25%

The lipid-derived phytohormone jasmonoyl-isoleucine regulates plant immunity, growth and development in vascular plants by activating genome-wide transcriptional reprogramming. In Arabidopsis (*Arabidopsis thaliana*), this process is largely orchestrated by the master regulator MYC2 and related transcription factors (TFs). However, the TFs activating this pathway in basal plant lineages are currently unknown. We report the functional conservation of MYC-related TFs between the eudicot Arabidopsis and the liverwort *Marchantia polymorpha*, a plant belonging to an early diverging lineage of land plants. Phylogenetic analysis suggests that MYC function first appeared in charophycean algae and therefore predates the evolutionary appearance of any other jasmonate pathway component. *M. polymorpha* possesses two functionally interchangeable *MYC* genes, one in females and one in males. Similar to AtMYC2, MpMYCs showed nuclear localization, interaction with JASMONATE-ZIM-DOMAIN PROTEIN repressors, and regulation by light. Phenotypic and molecular characterization of loss- and gain-of-function mutants demonstrated that MpMYCs are necessary and sufficient for activating the jasmonate pathway in *M. polymorpha*, but unlike their Arabidopsis orthologs, do not regulate fertility. Therefore, despite 450 million years of independent evolution, MYCs are functionally conserved between bryophytes and eudicots. Genetic conservation in an early diverging lineage suggests that MYC function existed in the common ancestor of land plants and evolved from a preexisting MYC function in charophycean algae. (The Plant Cell (2019) 2491-2509.)

1)給此研究下一個英文標題? (英文)

2)以下除了專有名詞外，需用中文敘述

a)這篇摘要敘述此研究在研究什麼樣的問題?

b)此研究用了哪些研究方法，這些研究得到什麼樣的結論?

c)此研究最主要的結論是什麼?

2. 25%

Recent investigations have revealed that, in addition to monolignols, some phenolic compounds derived from the flavonoid and hydroxystilbene biosynthetic pathways can also function as true lignin monomers in some plants. In this study, we found that the hydroxystilbene glucosides isorhapontin (isorhapontigenin-*O*-glucoside) and, at lower levels, astringin (piceatannol-*O*-glucoside) and piceid (resveratrol-*O*-glucoside) are incorporated into the lignin polymer in Norway spruce (*Picea abies*) bark. The corresponding aglycones isorhapontigenin, piceatannol, and resveratrol, along with glucose, were released by derivatization followed by reductive cleavage, a chemical degradative method that cleaves β-ether bonds in lignin, indicating that the hydroxystilbene glucosides are (partially) incorporated into the lignin structure through β-ether bonds. Two-dimensional NMR analysis confirmed the occurrence of hydroxystilbene glucosides in this lignin, and provided additional information regarding their modes of incorporation into the polymer. The hydroxystilbene glucosides, particularly isorhapontin and astringin, can therefore be considered genuine lignin monomers that participate in coupling and cross-coupling reactions during lignification in Norway spruce bark. (Plant Physiology (2019) 1310–1321.)

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3. 25%

Regulation of flowering by endogenous and environmental signals ensures that reproduction occurs under optimal conditions to maximize reproductive success. Involvement of the growth regulator gibberellin (GA) in the control of flowering by environmental cues varies among species. *Arabis alpina* Pajares, a model perennial member of the Brassicaceae, only undergoes floral induction during vernalization, allowing definition of the role of GA specifically in this process. The transcription factor PERPETUAL FLOWERING1 (PEP1) represses flowering until its mRNA levels are reduced during vernalization. Genome-wide analyses of PEP1 targets identified genes involved in GA metabolism and signaling, and many of the binding sites in these genes were specific to the *A. alpina* lineage. Here, we show that the *pep1* mutant exhibits an elongated-stem phenotype, similar to that caused by treatment with

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exogenous GA, consistent with PEP1 repressing GA responses. Moreover, in comparison with the wild type, the *pep1* mutant contains higher GA_4 levels and is more sensitive to GA prior to vernalization. Upon exposure to cold temperatures, GA levels fall to low levels in the *pep1* mutant and in wild-type plants, but GA still promotes floral induction and the transcription of floral meristem identity genes during vernalization. Reducing GA levels strongly impairs flowering and inflorescence development in response to short vernalization treatments, but longer treatments overcome the requirement for GA. Thus, GA accelerates the floral transition during vernalization in *A. alpina*, the down-regulation of *PEP1* likely increases GA sensitivity, and GA responses contribute to determining the length of vernalization required for flowering and reproduction. (Plant Physiology (2019) 1549–1563.)

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4. 25%

Starch is the major form of carbohydrate storage in plants and exists as discretestarch granules (SGs). Isolation of high-quality SGs in different plant tissues is a pre-requisite for studying the roles of SGs during plant growth, development, andresponses to abiotic stress. However, it is difficult to isolate transitory SGsfrom leaves and storage SGs from pollen grains due to their small sizes and lowquantities. Herein, we develop a novel method for isolating SGs by using the aque-ous two-phase system (ATS) of ethanol/NaH2PO4. The ATS method efficientlyseparated SGs from contaminants based on their differences in density, solubility,and polarity. Using this method, we first isolated and purified three kinds of SGsfrom maize seeds, pollen, and leaves. The biochemical, microscopic, and proteomicanalyses demonstrated the high purity of the isolated SGs. Proteomic analysisrevealed distinct differences in SG-bound proteins between seed SGs and pollenSGs. As a simple, rapid, and low-cost method, the ATS-based method exhibitshighly universal and reproducible results for starch-containing tissues in variousplant species. (Plant, cell and Environment (2019) 3355-3371.)

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