Nitric oxide is involved in the regulation of guard mother cell division by inhibiting the synthesis of ACC

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Abstract

A stoma forms by a series of asymmetric divisions of a stomatal lineage precursor cell and the terminal division of a guard mother cell (GMC). The symmetric division of the GMC is rigidly restricted to only once through complex genetic regulation mechanisms. Here, we show that nitric oxide (NO) is involved in the regulation of the GMC terminal division. NO donor treatment results in the formation of single guard cells (SGCs). SGCs are also produced in plants that accumulate high NO, whereas clustered guard cells (GCs) appear in plants with low NO accumulation. NO treatment promotes the formation of SGCs in the stomatal cell signaling mutants *sdd1, epf1 epf2*, *tmm1*, *erl2* and *yda-1*, reduces the cell number per stomatal cluster in the *fama-1* and *flp-1 myb88*, but has no effect on stomatal cells of *cdkb1;1 cyca2;2 cyca2;3 cyca2;4* quadruple mutants. Aminocyclopropane-1-carboxylic acid (ACC), a positive regulator of GMC division, reduces the NO-induced SGC formation. Further investigation found that NO inhibits ACC synthesis by repressing the expression of several *ACC SYNTHASE* (*ACS*) genes, and in turn ACC represses NO accumulation by promoting the expression of *HEMOGLOBIN 1* (*HB1*) which encodes a NO scavenger. This work shows that NO plays a role in the regulation of the GMC terminal division by modulating ACC accumulation in the Arabidopsis cotyledon.

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