EFFECTS OF FLORAL PRIMORDIA-TARGETED EXPRESSION OF ACS ON SEX EXPRESSION AND NATIVE SEX GENES IN MELON

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ABSTRACT

Melon (Cucumis melo L.) plants are typically andromonoecious, producing both male and bisexual flowers. Sex expression follows a developmental pattern beginning with a male-only phase that is followed by a male and bisexual phase. Ethylene has been implicated as the predominant hormone governing sex determination in melon. Previous research in our lab produced transgenic melons that express the dominant negative ethylene receptor etr1-1 under carpel and nectary-targeted (CRAB’S CLAW, CRC), or stamen and petal-targeted (APETALA3, AP3) promoters to determine critical primordia responsible for sex determination. AP3::etr1-1 plants showed an almost complete loss of carpel-bearing buds, however carpels on the CRC::etr1-1 plants continued to develop. These results indicated that ethylene perception in the stamen primordia is involved in carpel development. To identify the critical location of ethylene production to promote carpel development, transgenic melons were created expressing the ethylene biosynthetic enzyme gene, ACC synthase (ACS), under the AP3 and CRC promoters.

Transgene expression was verified in apices of T1 and BC1S1/BC2 progeny of CRC::ACS and AP3::ACS plants by quantitative RT-PCR (qRT-PCR) analysis. Ethylene evolution measurements of apical tissue showed an increase of ethylene in the 169 line, but no effect on native sex gene expression, or floral sex phenotype along the main stem of greenhouse grown plants (Figure 1a). PCR positive plants of AP3::ACS A4 and A5 exhibited elevated ethylene levels, and increased ACS7 (A locus) and decreased WIP1 (G locus) sex gene expression relative to controls. Greenhouse observations showed decreased male buds in both lines, and increased carpel-bearing buds and open flowers in A4. Sex expression along the main stem showed a loss of the male-only phase, and gain of a bisexual-only phase, not seen in wild type (Figure 1b). These results showed that increased ACS transgene expression targeted to the stamen and petal primordia, but not carpel and nectary primordia, affected native sex gene expression, and sex phenotype. These ethylene production results are consistent with the ethylene perception studies regarding the role of stamen primordia in regulating carpel development. These observations provide insight into the timing and location for ethylene production relative to melon sex expression and floral bud development decision points.

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