

Aminoacyl-tRNA Synthetases are Required for Reproductive Development in *Arabidopsis*

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Aminoacyl-tRNA synthetases (AARSs) are required for translation in three different compartments of the plant cell: chloroplasts, mitochondria, and the cytosol. Although elimination of this basal function should result in lethality early in development, phenotypes of individual knockouts may vary considerably, depending on patterns of gene expression, functional redundancy, allele strength, and protein localization. We describe here a reverse genetic screen of 50 insertion mutants disrupted in 21 of the 45 predicted AARSs in *Arabidopsis*. Our initial goal was to find additional *EMB* genes with a loss-of-function phenotype in the seed. Several different classes of knockouts were discovered, with defects in both gametogenesis and seed development. Three major trends were observed. Disruption of translation in chloroplasts often results in seed abortion at the transition stage of embryogenesis with minimal effects on gametophytes. Disruption of translation in mitochondria often results in ovule abortion before and immediately after fertilization. This early phenotype was missed in prior screens for embryo-defective mutants. Knockout alleles of non-redundant cytosolic AARSs were in general not identified, consistent with the absolute requirement of cytosolic translation for male and female gametophyte development. These results provide a framework for evaluating redundant AARS functions and predicted localizations in *Arabidopsis*, a valuable dataset of phenotypes resulting from multiple disruptions of a basal cell process, and insights into which genes are required for both gametogenesis and embryo development and therefore might escape detection in screens for embryo-defective mutants.

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