Epigenetic regulation of transposable elements drives plant speciation

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Polyploidization is a widespread phenomenon among plants and is considered a major speciation mechanism. Polyploid plants have a high degree of immediate post-zygotic reproductive isolation from their progenitors, as backcrossing to either parent will produce mainly nonviable progeny. This reproductive barrier is called triploid block and it is caused by malfunction of the endosperm. Our work revealed that paternal epigenetically activated small interfering RNAs (easiRNAs) are responsible for the establishment of the triploid block-associated seed abortion in *Arabidopsis thaliana*. Paternal loss of the plant-specific RNA polymerase IV suppressed easiRNA formation and rescued triploid seeds by restoring small RNA-directed DNA methylation at transposable elements, correlating with reduced expression of paternally expressed imprinted genes. Our data suggest that easiRNAs form a quantitative signal for chromosome number and their balanced dosage is required for post-fertilization genome stability and seed viability. Our data reveal a striking analogy of easiRNAs in establishing the triploid block with Piwi-interacting RNAs in hybrid dysgenesis in flies. In both models, TE-derived small RNAs transmit epigenetic information transgenerationally, pointing to a conserved role of TE-derived small RNAs in assessing gamete compatibility.