piRNA clusters adaptability after horizontal transfer of Transposable Element

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Abstract

On rare occasion, horizontal transfer (HT) of transposable elements (TEs) can occur, threatening the host genome integrity. In gonads, TE activity is suppressed by PIWI-interacting RNAs (piRNAs), a class of small RNAs synthesized by heterochromatic loci enriched in TE fragments, known as piRNA clusters. Maintenance of active piRNA clusters across generations is secured by maternal piRNA inheritance providing the memory for TE repression. Upon insertion of a newly acquired TE into the germline genome, it is commonly believed that the synthesis of specific piRNAs would trigger silencing, thereby ensuring the maintenance of this new TE in future generations. However, the timing of new piRNA emergence remains unclear. To address this question, we used TE-derived transgenes inserted in germline piRNA clusters, along with functional assays and playing with maternal and paternal inheritance of TE-derived transgenes, we have modeled the very first generations after a new TE inserted into a piRNA cluster in *Drosophila melanogaster*. By monitoring the synthesis of new piRNAs across generations, our findings indicate that the complete co-option of these transgenes by germline piRNA clusters can occur within a limited number of generations. Our analysis also revealed heterogeneity of piRNA distribution profile across piRNA cluster loci, never highlighted before. These observations underlie the high potential of adaptation of piRNA clusters, crucial for maintaining genome integrity.

Keywords: piRNA, piRNA cluster, drosophila, germline, Horzontal transfer

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