Abundant, diverse, and consequential P elements segregate in promoters of small heat-shock genes in Drosophila populations

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Author(s) Chen, B; Walser, J-C; Rodgers, T H; Sobota, R S; Burke, M K; Rose, M R; Feder, M E
Author(s) at UniBasel Walser, Jean-Claude ;
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The present study extends evidence that Drosophila heat-shock genes are distinctively evolvable because of insertion of transposable elements by examining the genotypic diversity and phenotypic consequences of naturally occurring P element insertions in the proximal promoter regions of two small heat-shock genes. Detailed scrutiny of two populations revealed 16 distinctive P transposable elements collectively segregating in proximal promoters of two small heat-shock genes, Hsp26 and Hsp27. These elements vary in size, orientation and insertion site. Frequencies of P element-containing alleles varied from 5% to 100% in these populations. Two Hsp26 elements chosen for detailed study, R(s)P(26) and D(2)P(m), reduced or abolished Hsp26 expression respectively. The R(s)P(26) element increased or did not affect inducible tolerance of high temperature, increased fecundity, but decreased developmental rate. On the other hand, the D(2)P(m) element decreased thermotolerance and fecundity. In lines subjected to experimental evolution, the allelic frequency of the R(s)P(26)P element varied considerably, and was at lower frequencies in lines selected for increased longevity and for accelerated development than in controls. Transposable element insertions into small Hsp genes in Drosophila populations can have dramatic fitness consequences, and therefore create variation on which selection can act.

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