Repression of hybrid dysgenesis in *D. melanogaster* males by the X-linked telomeric *P* element NA-\(P(1A)\).

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Repression of hybrid dysgenesis is anchored in *P* elements that have inserted in the Telomere Associated Sequences (TAS) at the left end of the X chromosome. These telomeric *P* elements confer the P cytotype, a regulatory state that is mediated by small RNAs that interact with the Piwi class of proteins; the RNAs are, therefore, called Piwi-interacting, or “pi”, RNAs. NA-\(P(1A)\) is a telomeric *P* element that produces *P*-specific piRNAs (Brennecke et al., 2008). This element, hereafter denoted simply as NA, is inserted at the junction of the distal retrotransposon array and the TAS of chromosome XL (Marin et al., 2000). The NA element is structurally incomplete, lacking the first 871 base pairs of the canonical *P*-element sequence, including the *P* promoter, the first *P* exon, the first *P* intron, and half of the second *P* exon; consequently, it cannot encode the transposase that catalyzes *P*-element activity or a truncated polypeptide that might interfere with this activity. The discovery that this element represses hybrid dysgenesis was a strong indication that cytotype regulation does not involve *P*-encoded repressor polypeptides.

Marin et al. (2000) demonstrated that NA represses hybrid dysgenesis in females. To determine if it also represses dysgenesis in males, we used a genetic test that detects excisions of the *P* elements inserted in \(sn^w\), a weak mutant allele of the X-linked *singed* bristle locus (Engels, 1979). Two incomplete *P* elements are inserted in the 5′ untranslated region of \(sn^w\) (Roiha et al., 1988). Excision of the upstream element converts \(sn^w\) into \(sn^f\), an allele with an extreme mutant phenotype. Excision of the downstream element converts \(sn^w\) into \(sn^{(+)\text{w}}\), a pseudo-wild allele. The extreme mutant and pseudo-wild phenotypes are easily distinguished from the weak mutant phenotype. We screened for *P*-element excisions from \(sn^w\) that occurred in the germ lines of males carrying \(sn^w\) and \(H(w^+, \Delta 2-3)\text{6}\), a hobo transgene that produces the P transposase (Merriman and Simmons, 2013). These males were crossed to females with attached-X chromosomes so that \(sn^w\) or its \(sn^f\) or \(sn^{(+)\text{w}}\) derivatives would be inherited patroclinously. The sons of these crosses were then scored on days 14 and 17 for the three bristle phenotypes (weak, extreme, and pseudo-wild), and the frequency of the extreme and pseudo-wild sons was used to estimate the germ-line \(sn^w\) excision rate. A reduced rate indicates that *P* excisions have been repressed.

The \(H(w^+, \Delta 2-3)\text{6}\) transgene contains a terminally truncated *P* element that lacks the last intron of the transposase gene—the one between exons 2 and 3 in a complete *P* element; hence its designation as \(\Delta 2-3\). This transgene, inserted on chromosome 3, produces the P transposase in the soma as well as in the germ line. Genetic analyses have shown that like the widely used P transposase source \(P(ry^+, \Delta 2-3)99B\) (Robertson et al., 1988), \(H(w^+, \Delta 2-3)\text{6}\) does not transmit...
transposase activity through the egg independently of the element itself—that is, \(H(w^+, \Delta2-3)6\) does not induce \(P\)-element excisions through a strictly maternal effect (Merriman and Simmons, 2013). The absence of such an effect allowed us to ascertain if \(NA\)-mediated regulation of \(P\) activity has a maternal component.

The experiment was similar to one that studied the regulatory abilities of \(TP5\) and \(TP6\), two other \(X\)-linked telomeric \(P\) elements (Simmons et al., 2004). It consisted of “reciprocal” crosses between \(yw\) flies heterozygous for the \(H(w^+, \Delta2-3)6\) transgene and flies hemizygous or homozygous for an \(X\) chromosome carrying \(NA\) and the markers \(w\) and \(sn^w\). The \(NA\ w sn^w\); \(H(w^+, \Delta2-3)6/+\) \(F_1\) males from these crosses were mated individually to \(C(1)DX\), \(y f\) females with attached-\(X\) chromosomes. Due to somatic production of the \(P\) transposase by the \(H(w^+, \Delta2-3)6\) transgene, these \(F_1\) males were all bristle mosaics; \(sn^w\) and \(sn^{(+)}\) or \(sn^e\) bristles were present on every fly. The \(NA\) element—like other telomeric \(P\) elements—therefore does not repress transposase activity in the somatic tissues. The sons of these \(F_1\) males were scored for their bristle phenotype to estimate the frequency of \(P\)-element excisions from the \(sn^w\) allele that had occurred in each \(F_1\) male’s germ line. To permit these sons to be scored unambiguously, the somatic mosaicism caused by the segregating \(H(w^+, \Delta2-3)6\) transgene had to be repressed by using attached-\(X\) females from a special strain in the \(F_1\) matings (Robertson and Engels, 1989; Simmons et al., 2004); this strain carries \(P\) elements that produce polypeptide repressors of somatic \(P\) activity.

<table>
<thead>
<tr>
<th>Stock</th>
<th>Cross A: (NA) inherited maternally</th>
<th>Cross B: (NA) inherited paternally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. vials</td>
<td>No. flies</td>
</tr>
<tr>
<td>(w) (sn^w)</td>
<td>32</td>
<td>928</td>
</tr>
<tr>
<td>(NA\ w) (sn^w) #1</td>
<td>32</td>
<td>1163</td>
</tr>
<tr>
<td>(NA\ w) (sn^w) #2</td>
<td>31</td>
<td>1117</td>
</tr>
<tr>
<td>(NA\ w) (sn^w) #3</td>
<td>31</td>
<td>949</td>
</tr>
</tbody>
</table>

To obtain these data, \((NA)\ w\) \(sn^w\); \(H(w^+, \Delta2-3)6/+\) \(F_1\) males were mated at 25°C to \(C(1)DX\), \(y f\) females from a somatic \(P\) repressor strain and their sons were scored for the three bristle phenotypes—\(sn^w\), \(sn^{(+)}\), and \(sn^e\). The \(F_1\) males were obtained from “reciprocal” crosses at 18 °C; cross \(A\) was \((NA)\ w\) \(sn^w\) females x \(yw\); \(H(w^+, \Delta2-3)6/+\) males and cross \(B\) was \((NA)\ w\) \(sn^w\) males x \(C(1)DX\), \(y f\); \(H(w^+, \Delta2-3)6/+\) females. The \(H(w^+, \Delta2-3)6\)-bearing flies for crosses \(A\) and \(B\) were obtained by mating \(C(1)DX\), \(y f\) females to \(yw\); \(H(w^+, \Delta2-3)6\) males at 25 °C. The three \(NA\ w\) \(sn^w\) stocks that were tested had been independently generated by recombining an \(NA\) \(w^{sp}\) \(X\) chromosome with a \(yw\) \(sn^w\) \(X\) chromosome and then making each \(NA\ w\) \(sn^w\) recombinant chromosome homozygous.

\(^a\) Unweighted excision rate, computed by averaging the proportion of \(sn^{(+)}\) and \(sn^e\) males among all the males in each culture; the standard error was calculated from the empirical variance among cultures.

Three independently generated stocks with the \(NA\ w\) \(sn^w\) \(X\) chromosome were tested along with a \(w\) \(sn^w\) control stock that did not carry \(NA\). In cross \(A\), the \(NA\) element was inherited maternally and the \(H(w^+, \Delta2-3)6\) transgene was inherited paternally. In cross \(B\), the derivations of \(NA\) and \(H(w^+, \Delta2-3)6\) were reversed. The results of the experiment are summarized in Table 1. For the control stock, the excision rate was 0.632 in cross \(A\) and 0.470 in cross \(B\). These rates indicate that \(H(w^+, \Delta2-3)6\) induces a high frequency of germ-line \(P\)-element excisions in the male germ line. We do not
know why the excision rate in cross A is significantly higher than in cross B. For the three NA stocks, the excision rates in cross A were significantly lower than the corresponding control rate (and also significantly lower than the control rate in cross B); however, the excision rates for the NA stocks in cross B were not lower than the rate for the cross B control. These observations indicate that P-element excisions in the male germ line are repressed, but only when the NA element is inherited maternally. Thus, regulation of P activity by NA, as by other telomeric P elements, involves a maternal effect, and an NA element that passes patroclinously from father to son loses its ability to repress hybrid dysgenesis.

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Influence of age on mating and fitness of Drosophila melanogaster.

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Abstract

The effect of age on mating time, remating duration, quantity of ACP transferred, fecundity, and productivity was studied within and between 7 and 26 days old Drosophila melanogaster. Mating time, accessory gland secretory protein transferred, fecundity, and productivity of 1st mating is more than the 2nd mating irrespective of age. The remating duration among young and old flies is almost similar, whereas it is more in different aged flies mating. Mating time, fecundity, and productivity are more in young flies compared to other combinations. In old flies mating time, fecundity, and productivity are more than the different aged flies. The fecundity is more if the female is young and productivity is more if the male is young in different aged flies mating. Key words: Drosophila, mating behavior, fecundity, productivity, age.

Introduction

Sexual reproduction occurs in a wide range of organisms. Reproductive capacity is particularly a good index of fitness in organisms that go through repeated cycles of rapid population growth, and it has evolved as a way for species to maximize their potential of survival. Mating is the most important and fundamental process of reproduction. Male fitness depends largely on the