STUDIES ON PARATHERESIA CLARIPALPIS (DIPTERA: TACHINIDAE). EFFECTS OF INBREEDING ON LARVA-ADULT VIABILITY

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ABSTRACT

Effects of inbreeding on female fertility and larva-adult viability were studied in three generations of sibling crosses in Paratheresia claripalpis.

The results have shown that viability decreases with an increase in the degree of inbreeding.

The percentages of adult flies obtained were 13.3, 12.6 and 6.2, respectively, for F₁, F₂ and F₃. By comparison, control crosses of unrelated flies produced 32.5% of adults.

INTRODUCTION

A population is genetically considered as a group of individuals of the same species in which gene interchange occurs through intercrosses among its members. The individuals may be related (inbreeding) as is usual in small populations, or unrelated (outbreeding), as in large populations.

Heterozygosis is favored by outbreeding, which maintains the genetic variability of the population at high levels. Inbreeding has opposite effects, leading to homozygosis of detrimental alleles.

When P. claripalpis is bred in the laboratory for the biological control of sugarcane moth borers, no special care is taken to prevent inbreeding. Each female of P. claripalpis produces many larvae. The pupae are kept together and the adults emerge almost at the same time, which entails mating between siblings.

Effects of inbreeding are known in several species of Drosophila, as in D. willistoni (Malogolowkin-Cohen et al.¹), D. pseudoobscura and D. ananassae (Stone et al.²), D. pseudoobscura (Dobzhansky³), D. arizonensis and D. mojavensis (Mettle⁴). Inbreeding leads to depression in egg-adult viability, and this depression increases as the values of the inbreeding coefficient become higher.

Effects of inbreeding on female fertility and larva-adult viability were studied in three generations of sibling crosses of P. claripalpis.
MATERIALS AND METHODS

The experiment was started with larvae collected in the Copersucar canefields in Sertãozinho, State of São Paulo, Brazil. Parasite larvae dissected from gravid females were placed on the integument of the hosts, as described by Scaramuzza. Generations of sibling crosses were produced while sufficient adults could be obtained to continue the experiment. Simultaneously, and under the same conditions, matings between unrelated flies were used as a control.

RESULTS

No behavior differences could be observed between the control and experimental matings.

TABLE I. Percentages of fertile females in crosses of *P. claripalpis* with different inbreeding coefficients (F).

<table>
<thead>
<tr>
<th>Crosses</th>
<th>F</th>
<th>Number of crosses</th>
<th>Fertile Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>110</td>
<td>73</td>
</tr>
<tr>
<td>F1</td>
<td>0.250</td>
<td>84</td>
<td>38</td>
</tr>
<tr>
<td>F2</td>
<td>0.375</td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td>F3</td>
<td>0.500</td>
<td>17</td>
<td>6</td>
</tr>
</tbody>
</table>

The number of fertile females (Table I) in the control (66.3%) was about 1½ times that of the F1 (45.2%) and nearly twice that of the F2 (34.4%) and F3 (35.3%). The inbreeding coefficients (F) were taken from Falconer.

TABLE II. Mean numbers of larvae, pupae and adults of *P. claripalpis* in the progenies of N matings with different inbreeding coefficients (F).

<table>
<thead>
<tr>
<th>Stages of development</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 (Control)</td>
</tr>
<tr>
<td>Larva</td>
<td>117</td>
</tr>
<tr>
<td>Pupa</td>
<td>47</td>
</tr>
<tr>
<td>Adult</td>
<td>38</td>
</tr>
<tr>
<td>N</td>
<td>23</td>
</tr>
</tbody>
</table>

Table II contains the mean numbers of larvae, pupae and adult flies in the progenies of the control and experimental matings. The mean numbers of larvae differ little up to F = 0.375, decreasing to little more than one half when F = 0.500. However, the differences are pronounced when pupae and adults are considered: the number of pupae in F2 (F = 0.375) and that of adults in F1 (F = 0.250) are smaller by more than 50% than
those of the control. Computing the adults as a percentage of the initial
numbers of larvae, the values are 32.5, 13.3, 12.6 and 6.2, respectively, for
the control, $F_1$, $F_2$ and $F_3$.

The $F_1$: $F_2$: $F_3$ proportions are approximately 7:5:1 for pupae, 4:3:1
for adults and merely 1.8:1.5:1 for larvae.

**DISCUSSION AND CONCLUSION**

This is the first recorded investigation of the effects of inbreeding on
larva-adult viability of *P. claripalpis*. The results are consistent with those
obtained for egg-adult viability in *Drosophila* (references mentioned above),
that is, viability decreases with increase in the degree of inbreeding.

This decrease may be associated with the genetic load components,
emerging in homozygous conditions as a consequence of the inbreeding
system of crosses. The present data seem to show that the effects of inbreed-
ing are more pronounced from the larval stage on.

These investigations indicate that sibling crosses, as well as any other
inbreeding, should be avoided when rearing *P. claripalpis* for biological
control purposes, and that better results should be obtained with an out-
breeding system of crosses.

**ACKNOWLEDGEMENT**

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**REFERENCES**

   (1964). Inbreeding and mutation and balanced loads in natural populations of
   populations of *Drosophila*: *Drosophila pseudoobscura*, a large dominant population.
   *Genetics*, 48:1089-1106.
   **XXXII.** Inbreeding and the mutational and balanced genetic loads in natural populations
   and Boyd Ltd. Edinburgh, 430 pp.
ESTUDIOS EN PARATHERESIA CLARIPALPIS. I. EFECTOS DE LO ENDOCRUZAMIENTO EN LA VIABILIDAD LARVA-ADULTO

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RESUMEN

Se estudiaron los efectos del endocruzamiento sobre la fertilidad de las hembras y sobre la viabilidad de larvas y adultos, en 3 generaciones provenientes del cruzamiento entre hermanos de Paratheresia claripalpis.

Los resultados mostraron que la viabilidad decrece con el aumento del grado de endocruzamiento.

Los porcentajes de adultos obtenidos fueron 13.3, 12.6 y 6.2 respectivamente para F₁, F₂ y F₃. En comparación, los cruzamientos de moscas no emparentadas produjeron 32.5% de adultos.