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Induction of a special Balbiani ring by position effect in the salivary gland chromosomes of *Acricotopus lucidus*

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Summary
Chromosome mutations were induced by X-ray treatment of males of *Acricotopus lucidus.* One of the larvae of the F_1-generation showed a dislocation of a segment of the centromeric region into an euchromatic part of the same chromosome as a consequence of mutation. In the new position, in some salivary gland cells, this segment expressed a distinct Balbiani ring. In other cells this Balbiani ring regressed, probably through the influence of ecdysone.

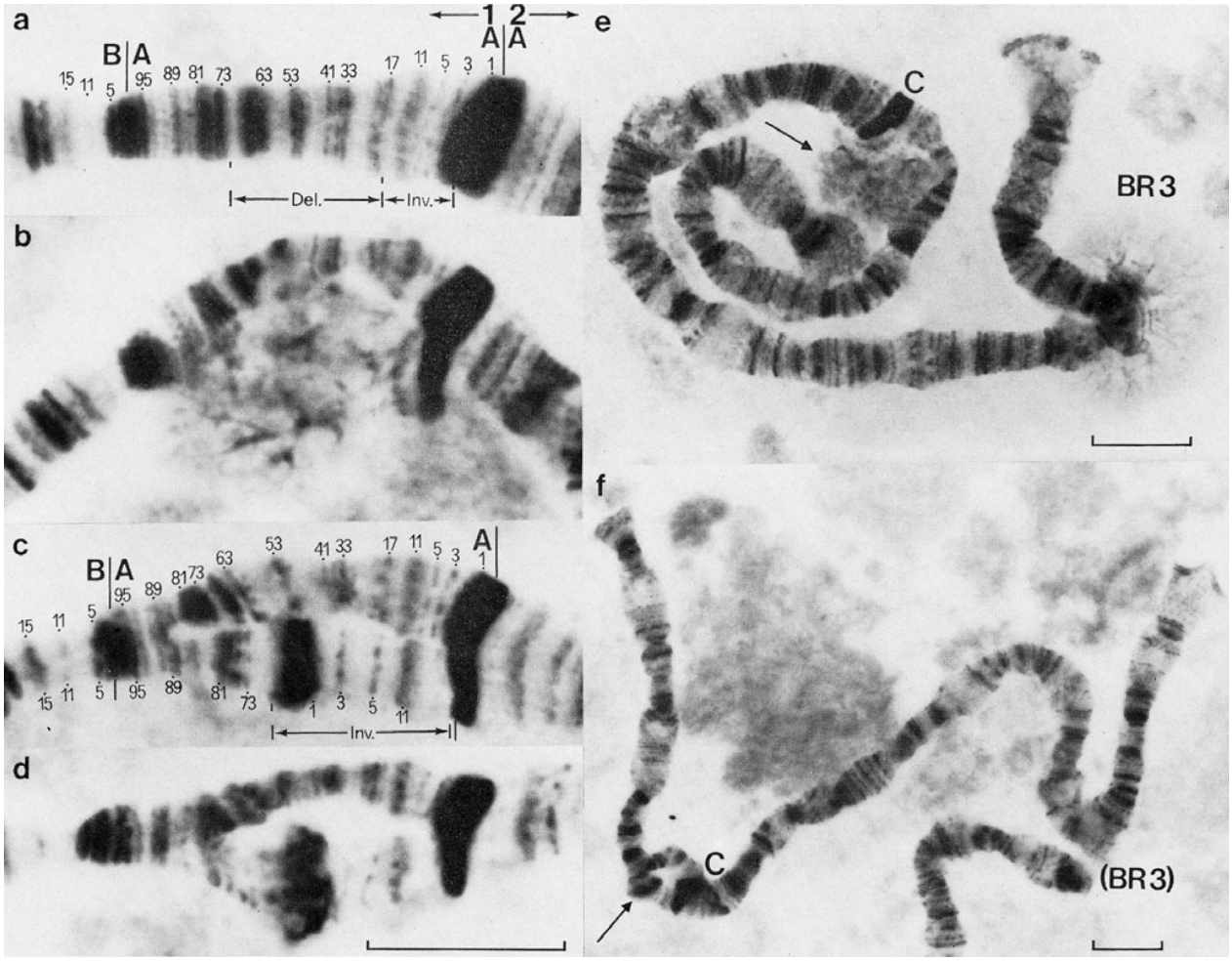
Male imagines of *Acricotopus lucidus* (Diptera, Chironomidae, Orthocladiinae) were exposed to X-rays and then paired with non-irradiated females. The radiation dose applied was about 1500-2000 R using a Seifert X-ray machine 'Eresco 200' at 200 kV, 5 mA. The examination of the salivary gland chromosomes of the F_1-generation showed that 57 of the 300 larvae checked had chromosome mutations (19%).

In the somatic cells of *A. lucidus* there are 2n = 6 chromosomes. They form 3 giant chromosomes in the salivary glands. The animals of the P-generation belonged to an inbred line (more than 12 generations) with the chromosomal constitution CF [1]. The salivary glands were fixed in ethanol-acetic acid (3:1) and stained according to the method described by Beermann [2].

The larval salivary gland of *A. lucidus* consists of 3 morphologically different lobes: anterior lobe, main lobe and side lobe[3]. Each lobe exhibits a specific Balbiani ring pattern[4]. During the transition from the 4th larval instar to the prepupal stage the Balbiani rings (BR) BR 3 and BR 4 (both specific to the anterior lobe) regress in a gradient from the top to the basis of the anterior lobe through the increasing concentration of the moulting hormone ecdysone[5]. Within the anterior lobe of an animal at such a transition stage (4th larval instar to prepupa) there are cells which have already reacted with respect to their puffing activity (BR regressed) to the secretion of the ecdysone, and others with still-active puffing (BR expanded). The centromeres of the

salivary gland chromosomes are represented by blocks (C) of extremely condensed chromatin. They divide the chromosomes into a short left and a long right arm.

One of the 57 mutants, in the transition stage, showed structural heterozygosity in the left arm of chromosome I in all salivary gland cells (fig., b-f) for a complex of an adjoining deletion and an inversion. The location of these rearrangements is shown in the figure, a. The deletion includes 28 bands (lA17-1A71; according to the unpublished chromosome map by Staiber and Behnke, bands with uneven and interbands with even numbers). One of the inversion breakpoints is located within the centromere. As a consequence, a part of the centromeric region is separated and transposed into a euchromatic part of the left arm (adjacent to band 1A73; fig., c).



a-d Division 1A of the left arm of chromosome I. **a** Homozygous banding pattern with mapping of the rearrangements; anterior lobe; Del., deletion; Inv., inversion, **b-d** Heterozygous division 1A. **b** Special BR expanded, BR 3-situation like in **e**; anterior lobe. **c** Regressed special BR, BR 3-situation like in **f;** anterior lobe. **d** Situation in all chromosomes of the main and side lobes, **e** Chromosome I with expressed special BR (arrow) and BR 3; anterior lobe. **f** Chromosome I with condensed locus of special BR (arrow) and completely regressed BR 3; anterior lobe. **b-f** Micrographs of the same salivary gland; BR, Balbiani ring; C, centromere. Scale bars = 10 µm.

The anterior lobe of the salivary gland of *A. lucidus* consists of 12-16 cells. In one of the salivary glands of the mutation carrying F_1-animal all 16 cells of the anterior lobe could be examined. In 10 cells, in which the BR 3 and BR 4 were fully expanded, the segment formed a BR (fig., b and

e), whereas in 6 cells, in which BR 3 and BR 4 were regressed, the segment was present in a slightly puffed or condensed form respectively (fig., c and f). Apparently the segment concerned has the same pattern of activity as the loci of BR 3 and BR 4. So one can suppose that in the new position its activity is under the control of ecdysone.

In all the cells of the main and side lobes the segment was still somewhat disaggregated like a regressing structure of a formerly expanded BR (fig., d).

In the normal position, integrated in the centromere, the segment never shows any puffing or RNA-synthesis (no incorporation of 3H-uridine, no specific RNA-staining by toluidine-blue- or methylgreen-pyronin-staining).

The expression of this special BR is interpreted as a position effect, due to a change of chromosomal structure[6-8].

Evidently, the locus is not able to express a BR in the regular position; in the new position, however, the locus is puffed to a BR. Another case of a position effect in *A. lucidus* has been described by Mechelke[9].

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