SALIVARY ANALYSIS OF INVERSION-3R-PAYNE IN THE "VENATION" STOCK OF DROSOPHILA MELANOGASTER

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INTRODUCTION

THE recessive mutation "venation" was found by C. B. BRIDGES and shown by genetic tests to be associated with a dominant suppressor of crossing over, both lying in the right limb of chromosome III. Salivary analysis by P. N. BRIDGES in the summer of 1936 showed that this suppressor is a simple inversion, with break points in 89C and 96A. Shortly after this, C. B. BRIDGES and J.-C. LI studied inversion 3R-Payne and found similar break points. This paper reports the accurate determination of the salivary characteristics of the Payne-R inversion. Of all the inversions known for *Drosophila melanogaster*, Payne-R is the one most frequently encountered in wild stocks collected at widely separated localities (STURTEVANT 1931) and is now the one most widely disseminated through the stocks of mutations, where it is a very useful balancer of third chromosome mutants or constitutes a troublesome impurity in at least ten percent of the stocks of first, second and fourth chromosome mutants. The Payne inversions have been very extensively studied genetically, and now, with this accurate determination of the salivary limits of Payne-R, should increase in significance and usefulness.

THE MUTATION "VENATION" AND ITS ASSOCIATED REDUCER OF CROSSING OVER

In the balanced stock of *fu*/ClB some of the fused and heterozygous Bar flies showed (July 18, 1933) a spontaneous mutant character. This was called "venation" since the most easily seen characteristics were an irregular thickening and a slight diffuse branching of the veins, especially of L_3 and of the crossveins which were closer together. There were several other ill-defined characteristics: bulging, scarlet-toned eyes; gnarled bristles; small size, and, as breeding tests soon showed, frequent sterility and a viability only about half that of normal (BRIDGES 1937).

F_2 cultures from the cross of venation to Plum Stubble gave a random distribution of venation with Plum (chromosome II) and gave 431 *Sb* to 104 *ven* flies, showing that venation is a low-viability recessive in the right limb of III. Testcross cultures of venation against Dichaete[3] Hairless

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gave: D^3 $H = 373$, *ven* - 201, D^3 *ven* = 7, $H = 19$, agreeing with the hypothesis of a low-viability recessive in IIIR, but showing that it is associated with a dominant inhibitor of nearly all the crossingover in that limb. A stock of venation balanced over Delta[5] was established (Stock 738, Drosophila Information Service 7:33).

LETHAL WITH VENATION

Some of the F_2 cultures of the cross of *ven* × *Pm Sb* gave the following totals: *Sb* = 347, *ven* = 3, indicating that the parental venation fly had been heterozygous for a recessive lethal (reported, BRIDGES 1937, as *l*(3)36d24; kept in balanced stock 739, Drosophila Information Service 7:33). That the lethal is separable from venation and occupies a locus near the spindle attachment of III was shown by crosses of D^3 *H/l ven* ♀ × *l ven/Sb* ♂, which gave (after discarding all *Sb* offspring): 557 D^3 *H*, 27 *H*, 3 D^3 *ven*, and 3 *ven*. This position was confirmed by the cross D^3 *l ven/H* ♀ × *l ven/Sb* ♂, which gave the following non-*Sb* offspring: 195 *H* and 27 D^3 *H*.

SALIVARIES OF VENATION

Permanent aceto-carmine preparations from female larvae of the type *ven*/D^3 *H* showed a medium-sized inversion loop in 3R (fig. 1a). The inversion includes nearly a third of IIIR, with the first break-point in 89C, just short of the middle of IIIR, and the second break in 96A, about one-fifth down from tip of IIIR. Highly characteristic of this inversion is the inclusion of the easily-recognized "duck's head" region, with the "weak spot" (at the tip of the "bill") very close to the right of the break.

Preliminary to a precise determination of the break points it was advisable to restudy and remap the normal banding in the neighborhood of the breaks. In figures 1b and 1c are given revisions of sections 89 and 90 and of 96, drawn from exceptionally clear well-stretched large chromosomes.

Study was centered on those heterozygous inversion figures in which a flat "open-square" configuration is formed at the junction point of the loop with the rest of the chromosome (figs. 1d and 1e). In such cases a direct comparison can be made between the two normal regions and the two inversion sequences. Furthermore, the synapsis of homologous bands helps to check the point at which change of partners occurs. It was found that the first break-point follows directly after the heavy doublet which begins 89C and precedes the three weak doublets of that subsection. The second break is about three-quarters of the distance along 96A, between two fairly strong doublets.

In a heterozygous inversion the crowding and bending of the strands at the junction point tend to obscure the banding, and also it is rare that the

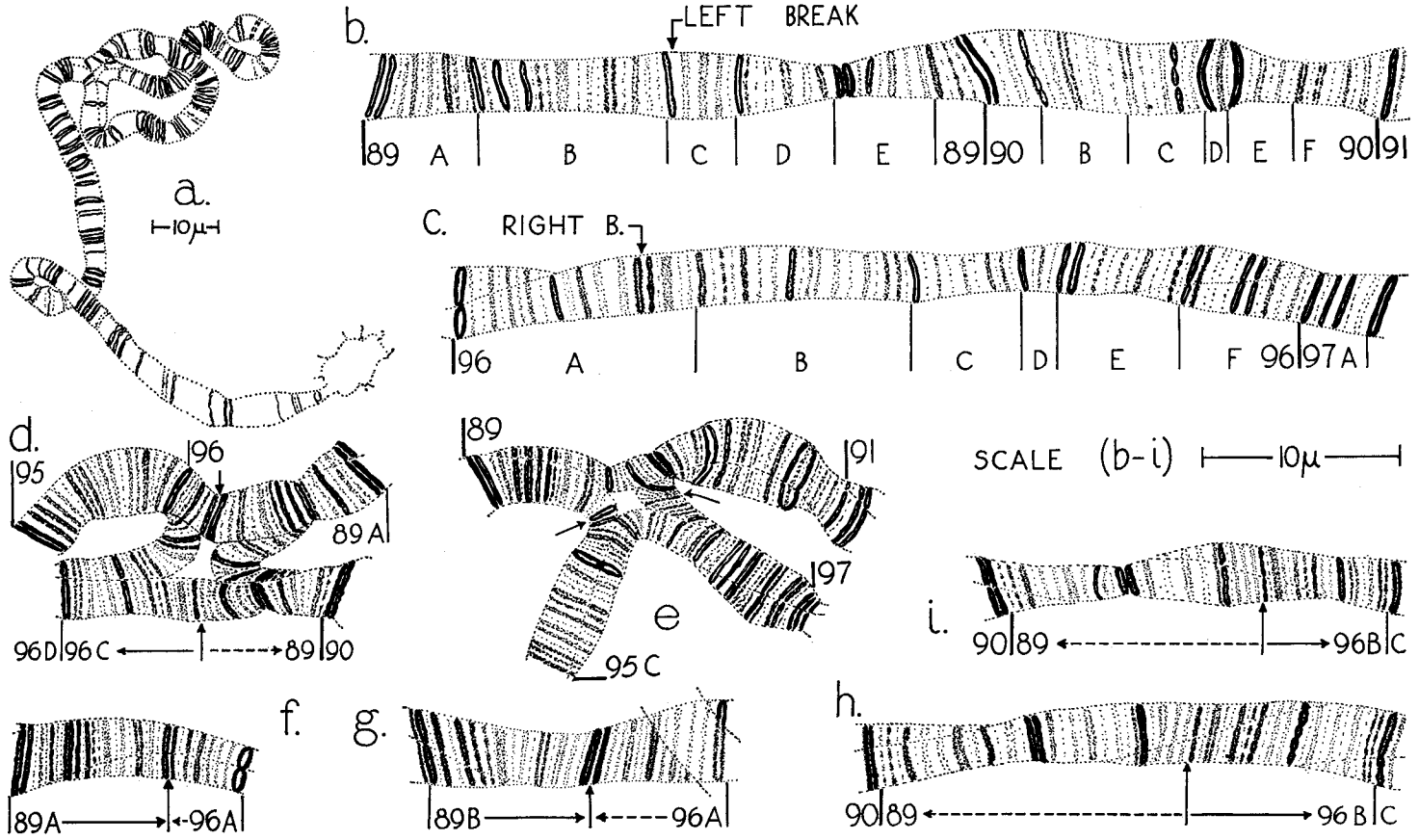

FIGURE 1.—Salivary chromosomes of Inversion-IIIR-Payne. a. General topography of IIIR of heterozygote. b–c. Revision of normal map for sections 89, 90, and 96, showing left and right break-points. d–e. Details of 4 strands at open-square junction in heterozygote (e enlargement of a). f–g. Homozygote, left abutment. h–i. Homozygote, right abutment.

loop itself is stretched enough to show the banding clearly. In a homozygous inversion there is no loop and the regions at the break-points can be examined in fully stretched undistorted condition. In preparations of homozygous venation with its inversion the easiest point of recognition of the inversion is the displacement of the "weak point" and "duck's head" from their normal central position in IIIR to a point four-fifths toward the free end.

Study of the region of the left break-point in the homozygous inversion (figs. 1f and 1g) showed the bands of 89 running through the strong doublet of 89C. But this doublet is now closely followed by a fairly strong doublet instead of by the normal sequence of three faint doublets. Then follows the characteristic banding of 96A and 95, in reversed sequence. The reversed sequence continues through 90 and through the faint doublets of 89C where, at the second break-point (figs. 1h and 1i), it abruptly encounters the fairly strong second doublet of 96A. The bands then proceed in normal sequence through the rest of 96 and on to the tip of IIIR.

A comparison of the break-points of the IIIR-inversion of the venation stock with the break-points of the highly important In(IIIR) Payne, which had been worked out somewhat later by C. B. BRIDGES and J.-C. LI, showed the two inversions to be identical. However, the In(IIIR)P^{ven} is free from a lethal which is inseparable from In(IIIR)P in the balancers "Payne" and "Payne, *Dfd ca.*"

SUMMARY

The recessive mutant "venation" (*ven*) has its locus in chromosome IIIR and is associated with a simple inversion. Salivary analysis of this inversion in heterozygous and homozygous form shows that it is the Payne-R inversion. Careful study places the left break-point of this important inversion directly after the heavy doublet which begins 89C, and the right break-point between the two fairly strong doublets at about three-quarters of the distance along 96A.

LITERATURE CITED

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