

LOCATION OF ESTERASE LOCI IN *Aedes aegypti*R. MARVDASHTI¹

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ABSTRACT. Linkage relations of two loci, *Est-4* and *Est-6*, have been studied in *Aedes aegypti*. *Est-4* is on chromosome I, the sex chromosome, about 33 units from the sex region on the opposite side from red eye (*re*). This location is demonstrated for the first time. Data for *Est-6* agree with results of other workers.

INTRODUCTION

Esterase isozymes have been extensively studied in *Aedes aegypti* (Linn.) because they are indicators of geographical variability (Tabachnick and Powell 1979) and because in some species they are implicated in insecticide resistance (Villani et al. 1983). Out of the six loci investigated so far, only one, *Est-6*, has been the subject of linkage studies. This is partly because it is the most variable and the easiest to score. The present work arose from a study of esterase variation in the stocks obtained from a variety of provenances and maintained in the laboratory of the University of Manchester by Dr. R. J. Wood.

MATERIALS AND METHODS

Three strains were used in the tests, kept at a temperature of $27 \pm 1^\circ\text{C}$ and a relative humidity of $80 \pm 5\%$. The visible markers used were present in the New 64 strain. These are sex and red eye (*re*) on linkage group I, yellow larva (*y*) and spotless abdomen (*sa*) on linkage group II, and black tarsus (*blt*) on linkage group III. Red eye is between 3 and 7 map units from the sex determining region on the long arm of chromosome I. The other two strains were Penang and NIH. *Est-6* was investigated using a fast allele from New 64 and one of medium mobility from Penang, while *Est-4* was studied using a medium allele from New 64 and a fast from NIH. For *Est-6* reciprocal crosses were made and the resultant progenies backcrossed to the marker stock. For *Est-4*, however, progeny were only obtained for the cross using New 64 as male. Females of this stock showed poor mating and egg-laying ability, perhaps as a result of extensive inbreeding. Homozygous flies were obtained by single pair mating and the parental crosses and subsequent backcrosses were then produced by mass mating. On average there were 100 individuals per cage with a sex ratio of 1:1. The visible markers were scored in the larvae or immediately after emergence and the isozymes were then scored. Standard vertical polyacrylamide gel apparatus was used (Shan-

don and Southern Co. Ltd.) and the runs stained with α - and β -naphthyl acetate. The running and staining techniques were essentially those of Sargent and George (1975) and Wilkinson (1970).

RESULTS AND DISCUSSION

In the *Est-4* cross the heterozygote had a male (M) chromosome I carrying *Est-4*^M and *re* derived from New 64, and a female (m) chromosome carrying *Est-4*^F and *re*⁺ derived from NIH. This was backcrossed to the *Est-4*^M m *re* homozygote. The resulting progeny types are shown in Table 1. Using these data *Est-4* is estimated to be 32.5 map units from sex, on the opposite side from *re*. The *re* locus is estimated to be 3.2 map units from sex, which is consistent with other studies of this locus.

The heterozygous parents of the *Est-6* crosses had chromosome II carrying *sa*⁺ *y*⁺ *Est-6*^M derived from the Penang stock and *sa* *y* *Est-6*^F derived from New 64. These were backcrossed to New 64. The reciprocal backcrosses produced progenies which were statistically homogeneous (for recombinant:non-recombinant ratio, $\chi^2_1 = 0.15$) so that the totals for each progeny class are given in Table 2. These data provide the map distances shown in Table 3, together with results obtained by previous authors. *Est-6* and *sa* lie on opposite sides of *y*, and the present results produce estimates of map distance which lie within the range seen in the published data.

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Table 1. Three point backcross of chromosome I in *Aedes aegypti*, involving *Est-4*.

Progeny type	Number
<i>Est-4</i> ^M M <i>re</i>	32
<i>Est-4</i> ^F m <i>re</i> ⁺	48
<i>Est-4</i> ^M m <i>re</i> ⁺	20
<i>Est-4</i> ^F M <i>re</i>	19
<i>Est-4</i> ^M M <i>re</i> ⁺	1
<i>Est-4</i> ^F m <i>re</i>	2
<i>Est-4</i> ^M m <i>re</i>	0
<i>Est-4</i> ^F M <i>re</i> ⁺	1

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Table 2. Three point backcross of chromosome II in *Aedes aegypti*, involving Est-6.

Progeny	Number
<i>sa y Est-6^F</i>	65
<i>sa⁺ y⁺ Est-6^M</i>	83
<i>sa⁺ y Est-6^F</i>	6
<i>sa y⁺ Est-6^M</i>	9
<i>sa y Est-6^M</i>	37
<i>sa⁺ y⁺ Est-6^F</i>	56
<i>sa y⁺ Est-6^F</i>	2
<i>sa⁺ y Est-6^M</i>	1

Table 3. Data on linkage of Est-6. The gene order is *Est-6 - y - sa*.

Reference	<i>Est-6 - y</i>	<i>y - sa</i>	Sample size
Present data	32.1	8.3	240
Trebatoski and Craig (1969)	17.4	9.0	882
Saul et al. (1976)	31.9	5.6	977
Munstermann and Craig (1979)	47.0	7.0	1079

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