

mine stock was only outcrossed once to Chico, it seems likely that this was the result of generalized hybrid vigor rather than overdominance at the *car* locus.

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INITIAL STUDIES ON THE GENETICS OF *Aedes SIERRENSIS*

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ABSTRACT. Basic cytogenetic information and the genetics of red eye (*r*), a recessive mutation in *Aedes sierrensis*, are briefly discussed in

relation to a current sterile-male control program.

INTRODUCTION

Aedes sierrensis (Ludlow), the western North American treehole mosquito, is one of the most annoying biting pests in recreational areas of the foothill and tree-stanced residential areas of California (Bohart and Washino 1978). Currently the species is incriminated as a vector of canine heartworm in several Northern California counties. Weinmann and Garcia (1974) experimentally infected female *Ae. sierrensis* with *Dirofilaria immitis*.

Ae. sierrensis is recorded from 52 of the 58 California counties (Loomis et al. 1956), and is widely distributed in other

western states. The species breeds in individual treeholes wherever wooded areas are found. The adults are day-time flyers, and the females feed on a range of warm-blooded animals including man. According to Carpenter and LaCasse (1955) males congregate outside of treeholes and around warm-blooded animals where they wait for females.

The species is a possible candidate for the sterile-male control method because of its unique ecology and the difficulties involved in the application of chemicals for its control. A program was initiated in 1977 (Terwedow and Asman) to determine the feasibility of using males sterilized by irradiation for genetic control, and subsequent tests in laboratory and large outdoor cage trials gave encouraging results (Anderson et al. 1979).

Genetic information on this species is essential as a basic tool for ecological as well as additional genetic studies. This paper deals with the basic cytogenetics of wild type *Ae. sierrensis*, and the genetics of

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what is believed to be the 1st reported mutant for this species.

MATERIALS AND METHODS

Several red-eye (*r*) mutants of both sexes were isolated from the Solano laboratory colony of *Ae. sierrensis*. This colony had originated from larvae taken in mid-December of 1974 from several walnut trees between Winters and Vacaville, Solano County, California. The mutant is assumed to be spontaneous. A 2nd colony, known as Russell Tree Farm, was used in several crosses. This colony was established in 1978 from larvae taken from tree holes on Russell Tree Farm, a research field station of the University that is located in Contra Costa County, California. All specimens used in the genetic crosses were maintained at 24°C, 75% R.H., and a light cycle of 15 L: 9 D including 1 hr of dim light to simulate dawn and dusk. Each generation of eggs was allowed a maximum embryonation time of 15 days under optimum rearing conditions prior to initiation of the hatching process. In order to get consistently high and synchronous hatching the embryonated eggs were stored at a cold temperature for 24 hrs. The cold treated eggs then were placed in small containers (150 ml capacity) to which a weak solution of Bacto-Peptone (Difco powder brand) had been added 24 hrs earlier. After 24 hrs the hatched larvae were separated into larger plastic rearing pans holding 1200 ml distilled water. The larval diet consisted of 0.6 gm of ground Purina rat chow added every 3rd day. Pupation was reached approximately 2 weeks from the day of egg hatch. Eye colors were scored in the pupal stage, as it is difficult to separate red eye (*r*) from wild type after adults are over 12 hrs old.

Once the mutant colony was firmly established, reciprocal outcrosses to wildtype individuals were followed to the F_2 generation. Backcrosses of the F_1 were also made to determine the mode of inheritance of red eye (*r*) and its possible chromosome correlation.

RESULTS AND DISCUSSION

The karyotype of *Ae. sierrensis* is $2n=6$, and the meiotic chromosomes (Figure 1) are similar in structure and size to other *Aedes* species (Rai 1963). At maximum contraction of metaphase I the smallest pair is metacentric and averages $6.1 \mu\text{m}$, the one medium in size is slightly submetacentric and averages $7.4 \mu\text{m}$, and the longest is metacentric and averages $8.6 \mu\text{m}$. Sex is assumed to be determined by a single pair of alleles, *M* and *m*, as in other culicine mosquitoes that lack heterosomes (Gilchrist and Haldane 1947). Following that assumption, *M* is dominant for which the male is heterozygous (*M/m*). Females are determined by homozygosity of *m* (*m/m*).

The normal eye color of *Ae. sierrensis* is black or brownish-black. The red-eye mutants (*r*) have distinctive bright red pigment in both the compound eye and in the ocelli. The mutant can be easily distinguished from the normal individuals as larvae, pupae, and as young adults for a period up to 12 hr after emergence.

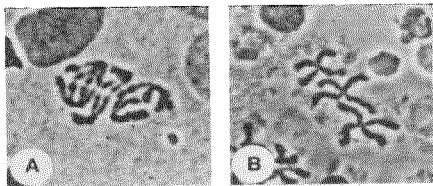


Fig. 1. Meiotic metaphase I (A) and metaphase II (B) chromosomes in *Aedes sierrensis*.

Simple reciprocal crosses of *r* and wild to the F_2 generation, and back-crosses of the F_1 indicated the mutant was recessive to the normal eye color and inherited independently of sex (*M*) (Table 1). The χ^2 value in the 1st cross is significant ($P < .05$); this is probably due to the deficiency of the mutant type. Although the data indicated autosomal linkage, it is remotely possible that *r* is on the same chromosome as the sex determining

Table 1. Segregation of eye mutant red eye (*r*) from single-pair crosses between it and normal-eyed *Aedes sierrensis*.

Parents		Phenotypes						
		normal eye			red (<i>r</i>) eye			χ^2
		♀	♂	Total	♀	♂	Total	
$\frac{r}{r}$	$\frac{m}{m}$ × $\frac{r}{+}$	152	132	284	120	112	232	5.0
$\frac{r}{+}$	$\frac{m}{m}$ × $\frac{r}{r}$	340	318	658	346	294	640	0.2
$\frac{r}{+}$	$\frac{m}{m}$ × $\frac{r}{+}$	135	150	285	35	40	75	3.2

factor but is at some distance from *M*. Additional sex-linked markers will be needed to confirm the present assumption. It is of interest to note that in *Ae. aegypti* red-eye is sex-linked (McClelland 1962). This is also the case in *Culex pipiens* (Wild 1963). However, a red-eye mutant in *Cx. tarsalis* known as carmine eye (*car*) is autosomal (Asman 1975). The penetrance of *r* is complete with uniform expression in both sexes. These characteristics will allow the mutant to be used as a tracer element for both laboratory and field experiments in genetic, behavioral, and ecological studies.

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