GENETICS OF *VENTRALLY SPACED* EYES IN *ANOPHELES CULCIFACIES*

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ABSTRACT. The genetics of a new mutation, *Ventrally spaced* eyes, *Vs*, in the malaria vector, *Anopheles culicifacies*, was investigated. The data indicate that *Vs* is dominant, sex linked and lethal in males. The observed frequency of recombination between *Vs* and another sex linked mutant, *rose eye, re*, was approximately 15%.

During routine handling of the Sattoki wild type strain of the malaria vector, *Anopheles culicifacies* Giles, 1 female was recovered with a gap ventrally between her 2 eyes (Fig. 1). This mutant has been named *Ventrally spaced* eyes, *Vs*, and is phenotypically similar to the *ae* mutant in *Culex tritaeniorhynchus* (Sakai et al. 1976) and *e* in *Aedes aegypti* (Bhalla et al. 1975). The *Vs* female was crossed to a wild type male and produced progeny consisting of *Vs* and + females and + males. Sib matings between the *Vs* females and their + brothers also resulted in *Vs* and + females and + males. In more than 20 generations of observations no *Vs* male has been recovered.

In *An. culicifacies* sex is determiend by a XX-XY mechanism in which the females are the homogametic sex (Aslamkhan and Baker 1969, Sakai et al. 1977). The Y chromosome appears to be the controlling element as triploid XXX individuals are females and XXY, males (Baker and Sakai 1979).

MATERIALS AND METHODS

The following strains were used to investigate the inheritance of *Vs*:

1) *rose eye, re*—a recessive, sex linked, red eye mutant (Sakai et al. 1977).
2) *Ventrally spaced* eyes, *Vs*—the *Vs* mutant described above.
3) *Vs re*—a strain with both mutations.
4) Sattoki—a wild type strain (Ainsley 1976).

Mass matings were made in 1 gal (3.8 liter), cardboard, cylindrical cartons. After feeding on mice, gravid females

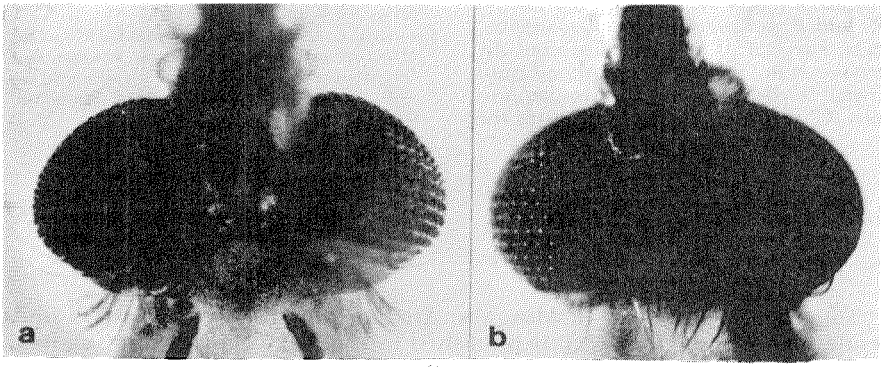

Figure 1. (a) *Vs* female, (b) normal female.

were individually isolated in filter paper-lined vials for oviposition. The progeny from each female were raised as a family. The resulting adults were classified for sex and eye phenotypes. The polytene and mitotic chromosomes from ovaries from *Vs* females were investigated by methods described by Saifuddin et al. 1978.

RESULTS AND DISCUSSION

Table 1 summarizes the crosses done to elucidate the mode of inheritance of *Vs* and Table 2 contains the chi-square analysis of the data from Table 1 and the observed frequency of recombination between linked loci. Each family was scored individually but since no significant heterogeneity was observed among families within a cross type, the data were pooled in Table 1.

Cross 1 is between *Vs* females and wild type males and cross 2 between *Vs* females and *re* males. The progeny in both crosses consisted of *Vs* and + females and + males in a 1:1:1 ratio. The sex ratios were greatly distorted in favor of females (Table 2). The presence of *Vs* females among the F_1 progeny of both crosses suggests that *Vs* is dominant. Crosses between wild type females and the + sib

Table 1. Summary of crosses to elucidate the genetics of *Vs*.

Cross No.	Proposed Parental Genotypes* ♀	♂	f**	Propeny Phenotypes ♀ + +	♀ Vs +	♀ + re	♀ Vs re	♂ + +	♂ Vs +	♂ + re	♂ Vs re
1	Vs + X / + + X	+ + X / − Y	7	210	214	—	—	192	0	—	—
2	Vs + X / + + X	+ re X / − Y	4	130	111	0	0	106	0	0	0
3	Vs re X / + re X	+ + X / − Y	5	164	134	0	0	0	0	137	0
4	Vs re X / + + X	+ re X / − Y	11	311	42	49	268	273	0	54	0
5	Vs + X / + re X	+ re X / − Y	18	83	354	372	50	67	0	378	0

* X = X chromosome, Y = Y chromosome.
** Number of families tested.

Table 2. Chi square analysis of data from Table 1 and the observed frequency of recombination between *Vs* and *re*.

Cross No.	Chi squares testing for: 1:1 segregation ♀:♂	+:*Vs* all data	+:*Vs* ♀ data only	+:*re* ♀ data only	2:1 segregation ♀:♂	linkage *Vs–re*	% recombination *Vs–re*
1.	87.37**	57.38**	0.04	—	1.30	—	—
2.	52.52**	45.03**	1.50	—	1.21	—	—
3.	59.59**	64.11**	3.02	—	0.66	—	—
4.	118.0**	142.6**	3.73	1.93	0.13	501.4**	14.54 ± 1.11
5.	131.4**	188.7**	3.03	0.26	0.37	626.7**	15.34 ± 0.99

** $P < 0.01$.

brothers of *Vs* females or between + sib females and males of *Vs* females did not produce any *Vs* individuals. Moreover, the absence of *Vs* males and the recovery of only half the expected number of males among the progeny of these crosses suggest that *Vs* is lethal in males. Egg hatchability and larval survival data suggest that the *Vs* males die during the larval stage before pupation occurs.

Cross 3 is between *Vs re* females and wild type males and the progeny consisted of wild type and *Vs* females and *re* males. Four and 5 are crosses of *re* males to females heterozygous for *Vs* and *re* in coupling and repulsion, respectively. The data from crosses 4 and 5 show linkage between *Vs* and *re* (Table 2) and the observed frequencies of recombination between these 2 loci are in close agreement in both crosses. Since no significant heterogeneity was observed between the results of crosses 4 and 5, the data were pooled and the overall frequency of recombination between *Vs* and *re* was 14.99 ± 0.74%. *Rose eye* had previously been shown to be sex linked (Sakai et al. 1977); therefore, *Vs* is also assigned to linkage group I (Chromosome 1).

The ovarian polytene and mitotic chromosomes of adult *Vs* females were examined. Thus far no chromosomal aberration, deletion or duplication have been observed.

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