

CONCLUSION. We think it is of interest to report the results of experiments on the parasitism of *C. nubeculosus* on engorged Culicidae. This represents a new record. *C. nubeculosus* is indeed able to attack mosquitoes. This phenomenon has not been observed in the field, but can be obtained without artifice in the laboratory. The *Culicoides* take blood previously ingested by their victims, but they seem not to attack non-engorged *Aedes*. These blood meals give rise to normal ovarian development. Indirect acquisition of vertebrate blood meals by *Culicoides* could play a role in the transmission of pathogenic agents. But this is a question still practically unexplored.

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### X-RAY INDUCED INVERSIONS IN *ANOPHELES ALBIMANUS* W.

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Chromosomal polymorphism has not been detected in natural populations of *Anopheles albimanus* (Keppler, et al. 1973) although other species belonging to the same subgenus (*Nyssorhynchus*) have moderate to high amounts of naturally occurring inversion polymorphism. Natural populations of *A. darlingi*, *A. albirtarsis*, *A. argyritarsis*, among others, are quite rich in inversions (Kreutzer et al. 1972; Kreutzer, Kitzmiller, and Rabbani, in preparation).

Inversions in *Anopheles albimanus* may be produced with ease by the use of X-rays and therefore *albimanus* is not inherently refractory to the production of such aberrations. The purpose of this paper is to describe some inversions that we have been able to produce and to maintain in our laboratory.

The stock colony used was originally collected in Panama and has been maintained since 1970.

Males 1 to 4 days old were X-irradiated with 4,000 R at the rate of 200 R per minute and mated to virgin females of the same age. After mass-mating with their sibs the F<sub>1</sub> females were blood-fed on guinea pigs and isolated in shell vials for oviposition. Individual F<sub>2</sub> families were reared separately. Rearing of the larvae, maintenance of the adults and screening for inversions by the use of salivary gland chromosomes followed the methods reported previously (Rabbani and Kitzmiller, 1972).

Both pericentric and paracentric inversions were isolated. Table 1 lists the inversions obtained, some of which are being maintained. The numbers indicating break-points appear on the salivary gland chromosome map prepared by Keppler et al. (1973), which has been taken as the standard for the banding sequence. Figure 1 shows some of the inversions described in Table 1.

Inversions, long paracentric ones in particular, are interesting for cytogenetic investigations because of their importance as cross-over suppressors. Inversions have already been used in linkage group-chromosome correlation and crossing-over suppression studies in mosquitoes (Baker et al.

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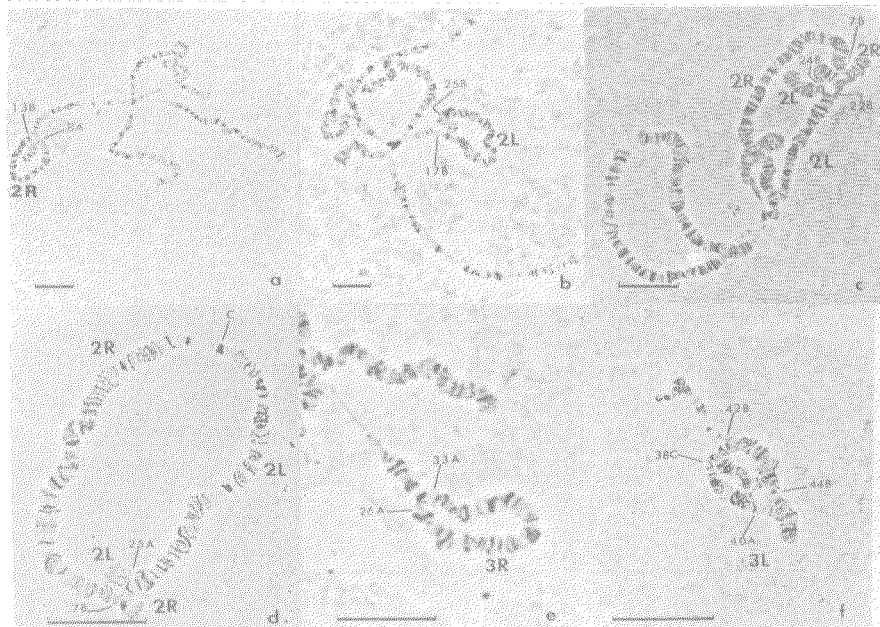


FIG. 1. Salivary gland chromosomes of some inversion heterozygotes. Solid lines at the bottom left of a through f represent 25 microns.

- a. *In(2)1*
- b. *In(2)5*
- c. *In(2)6*
- d. *In(2)12*, C=centromere
- e. *In(3)10*
- f. *In(3)2, In(3)3*; double heterozygote

1971; Bhalla, 1970, 1971, 1973). Inversions are also considered one of the important mechanisms of variability and plasticity in a population. Salivary gland chromosome banding pattern differences between related species can sometimes be explained by a series of overlapping inversions. Speciation within the "maculipennis complex" could have occurred by such events (Kitzmilller *et al.* 1967). Similar findings were encountered in the species of the subgenus *Cellia* (Narang *et al.* 1973) and subgenus *Nyssorhynchus* (Kreutzer *et al.* 1972; Kreutzer, Kitzmilller, and Rabhani, in preparation). Although several closely related species are polymorphic, the fact that not a single inversion has been recorded from natural populations of *A. albimanus* is interesting, especially since it is quite easy to produce chromosomal inversions in the laboratory.

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TABLE 1. Inversions in *Anopheles albimanus*.

	Break-points	Explanations/comments
<i>In(X)1</i>	1B, 4A/B	paracentric
<i>In(2)1</i>	8A, 13B	paracentric, see Fig. 1a
<i>In(2)2</i>	6A, 25A	pericentric
<i>In(2)3</i>	12A, 21A/22B	pericentric
<i>In(2)4</i>	18A, 23A	paracentric
<i>In(2)5</i>	17B, 25B	paracentric, see Fig. 1b
<i>In(2)6</i>	22B to 24B inserted on 2R at 7B	inter-arm insertion, see Fig. 1c
<i>In(2)7</i>	10C, 24A	pericentric
<i>In(2)8</i>	14B, 15A	paracentric
<i>In(2)9</i>	18A, 24C	paracentric
<i>In(2)10</i>	11A, 25B	pericentric
<i>In(2)11</i>	9B, 10C	paracentric
<i>In(2)12</i>	7B, 25A	pericentric, see Fig. 1d
<i>In(2)13</i>	9B, 14A	paracentric, induced in the translocation stock <i>T(Y;2R)1</i>
<i>In(3)1</i>	26B, 44B	pericentric
<i>In(3)2</i>	38C, 44B	paracentric
<i>In(3)3</i>	40A, 42B/C	paracentric, isolated with <i>In(3)2</i> , see Fig. 1f
<i>In(3)4</i>	26B, 29A	paracentric
<i>In(3)5</i>	29A, 45B	pericentric, isolated with <i>In(3)4</i>
<i>In(3)6</i>	26A, 45A	pericentric
<i>In(3)7</i>	40C, 42A	paracentric
<i>In(3)8</i>	41B, 44B	paracentric
<i>In(3)9</i>	32C, 38B	pericentric
<i>In(3)10</i>	26A, 33A	paracentric, see Fig. 1e

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