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## *CULICOIDES NUBECULOSUS* (CERATOPOGONIDAE) FEEDING ON ENGORGED *AEDES AEGYPTI* UNDER LABORATORY CONDITIONS

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It has been reported several times that *Culicoides* and other Ceratopogonidae feed on insects (Wirth, 1956, 1971a, 1971b). A well known example is *Culicoides anophelis* which engorges on mosquitoes (Das Gupta, 1964). We have reported the capture of five different species of *Culicoides* from Madagascar, the *Culicoides* having been caught at the same time as *Anopheles coustani,* and their "entomophagy" seemed very likely (Callot *et al.,* 1968).

We report here experiences with *Culicoides nubeculosus* (Meigen) feeding on *Aedes aegypti.* Both strains of insects have been reared in the laboratory for several years.

First we put in a 125 cc cardboard container, closed with fine nylon mesh, some *Culicoides* which were 4 or 5 days old, and nourished exclusively with sugar-water. Then we introduced one or two *Aedes aegypti* which had just fed on man or mouse. Some females of *Culicoides* were able, but with great difficulty, to cling to the mosquito, then to attack and maintain themselves on the abdomen of the *Aedes.* However, it is obvious that the mosquitoes try to avoid any contact with the *Culicoides.* The female *Culicoides* engorge on the blood previously ingested by the *Aedes,* their abdomens enlarge and take the usual dark red color. We obtained by this procedure viable eggs. (*C. nubeculosus* is not autogenous under our laboratory conditions.)

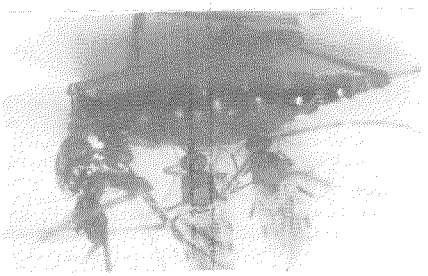

FIG. 2. *C. nubeculosus feeding on engorged A. aegypti.*

To take photographs of the phenomenon, and to observe it better, we introduced engorged *Aedes,* anaesthetized or with a crushed thorax, to reduce movements. (Fig. 1–3.) We observed that the female *Culicoides,* aged 4 and 5 days and still unnourished with blood, regularly attacked their victims, penetrating the abdominal pleural membrance and engorging on blood. They are able in this way to "empty" completely the abdomen of the *Aedes.*

During that time, the males are extremely active and mate with the females. Also, they try to do so with the wounded female *Aedes.*

The same trials done with wounded *Aedes,* which had not fed on blood, failed to show the same phenomenon until now. *Culicoides* of both sexes seem to be "attracted" by the *Aedes,* stay on them, the mouth parts in contact with the cuticle, but they did not attempt to feed. This contrasts with observations of other authors.

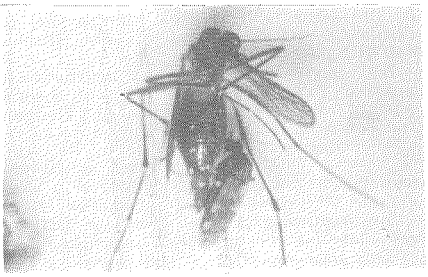

FIG. 1. *C. nubeculosus feeding on engorged A. aegypti.*

FIG. 3. *C. nubeculosus* feeding on engorged *A. aegypti* (detail).

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 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. albitarsis, 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 $F_1$ females were blood-fed on guinea pigs and isolated in shell vials for oviposition. Indvidual $F_2$ 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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