

DIFFERENCES IN CARBOHYDRATE RESERVES BETWEEN RESTING AND FLYING *CULEX NIGRIPALPUS* COLLECTED IN THE FIELD¹

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Laboratory experiments with *Aedes* mosquitoes tethered to flight mills have been used to demonstrate that the predominant, if not the only, substrate for mosquito flight is carbohydrate (Nayar and Van Handel 1971). In the laboratory, sucrose is quickly converted to glycogen. Once a glycogen threshold has been reached, females convert excess sugar to fat which is used for long-term maintenance (Van Handel 1965, 1984).

Culex nigripalpus Theobald is an abundant subtropical species and an important vector of St. Louis encephalitis virus in Florida and Central America (Chamberlain et al. 1964). The flight range and longevity of these mosquitoes in the field is an important aspect of the epidemiology of this disease (Provost 1969) and depends, in part, on their ability to locate, obtain, and use carbohydrates. The purpose of the present study was to compare the differences in nutritional reserves between resting and flying mosquitoes of this species taken in field collections.

A power aspirator was used to collect resting mosquitoes from a cabbage palm (*Sabal palmetto*)/live oak (*Quercus virginiana*) hammock 6.4 km SW of Vero Beach, Florida. Two, 10-min collections were made between 0800 and 0900 hr three times a week from late September through mid-November, 1987. At the conclusion of each collection, aspirator bags were placed into a chilled, darkened cooler and returned to the laboratory. There mosquitoes were lightly chloroformed, identified and non-blood fed, non-gravid (empty) *Cx. nigripalpus* females were frozen immediately at -80°C until analysis. Approximately one hour elapsed between the collection and the freezing of these specimens.

On nights prior to the aspirator collections, CDC light traps and chicken-baited lard can traps were used to sample flying mosquitoes at the hammock site. Each trap contained a plastic strip impregnated with 2,2 dichlorovinyl dimethyl phosphate, a potent insecticide, which

killed mosquitoes soon after entering the trap and prevented additional expenditure of nutritional reserves during the night. The sugar and glycogen content of mosquitoes which were taken from morning aspirator collections, killed, and maintained at room temperature for 24 hr was not different from that of mosquitoes analyzed immediately after capture and therefore, the low carbohydrate content of flying mosquitoes was not due to post-mortem breakdown. Empty *Cx. nigripalpus* females from both types of traps were stored as above.

Empty mosquitoes from aspirator, light trap, and lard can trap collections were divided into pools of 10 females each. Four pools from each collection were analyzed for sugar and glycogen (Van Handel 1985a). Four additional pools from each collection were analyzed for lipid (Van Handel 1985b). Sixty-four aspirator ($n = 2,560$ ($4 \times 10 \times 64$) mosquitoes), 30 lard can ($n = 1,200$) and 36 light trap ($n = 1,440$) collections were analyzed (Fig. 1).

There was no difference between fuel reserves of mosquitoes caught in light or lard can traps. All of the mosquitoes attracted to the chicken-baited traps were host-seeking or they would not have been captured. Since the reserves of these mosquitoes did not differ from those collected in the light trap, it is probable that empty females attracted by light may also have been host-seeking.

There was no difference in the lipid content of mosquitoes taken in flight by either light or lard can traps. The lipid content of flying mosquitoes was slightly higher than that of resting mosquitoes strongly supporting conclusions from laboratory observations that lipid is not the flight fuel.

Glycogen content was significantly ($P < 0.001$, $t = 7.848$, $df = 24$) higher in resting mosquitoes compared with those taken in flight. Likewise, sugar content was significantly ($P < 0.05$, $t = 2.689$, $df = 24$) higher in resting mosquitoes. The difference between resting and flying mosquitoes was 15 μg for sugars and 45 μg for glycogen. This represents 0.06 mg carbohydrate or 0.24 cal ($4 \text{ cal/mg} \times 0.06 \text{ mg}$) of flight energy.

There are at least two explanations for this 60 μg difference between the carbohydrate re-

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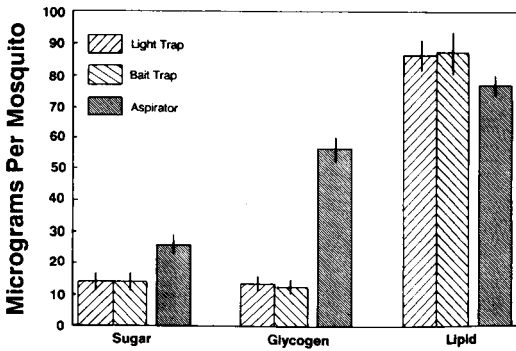


Fig. 1. Mean (\pm SE) sugar, glycogen and lipid content of female *Culex nigripalpus* collected in flight and at rest. Mosquitoes analyzed from light trap collections totaled 1,440, bait trap collections 1,200, and aspirator collections 2,560.

serves observed in resting and flying mosquitoes. The first is that flying mosquitoes did not come from the resting site, but rather, had already flown a considerable distance. The second is that the resting population was not homogeneous and contained individuals of widely different sugar and glycogen content. If this second case is true, then it is possible that only individuals whose nectar content in the crop, or whose circulating hemolymph sugar, or intracellular glycogen content had fallen below a certain critical threshold, were stimulated to fly and were captured in either the light or bait traps. It seems unlikely that the traps used for this study selectively attracted mosquitoes which had flown a

long distance, since the traps were located at the resting site in a position to intercept mosquitoes as they exited the hammock at the start of the evening flight. It seems more likely that mosquito flight is initiated by low carbohydrate titers.

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