still had size differences between the sexes although size ranges overlapped. He therefore concluded that sexing of pupae by size would depend on the maintenance of favorable uniform rearing conditions. In other species, e.g., *A triseriatus*, there was an overlap of size ranges and in *A. vexans*, very little difference in size at all.

Difference in size of sexes is also the basis for large scale separation operations. Fay and Morlan (1959) devised a machine for the separation of stages and sexes of mosquitoes. The apparatus ran with an error factor of 2 percent females in male fractions. It allowed for the separation of sexes at a rate of 3,000/hour. McCray (1961) went on to devise a machine with an error factor averaging 1.3 percent. Only 1 of 58 samples had an error factor exceeding 5 percent, due to initial mechanical difficulties. With this device specimens could be separated by sex at a rate of 30,000/5 minutes; 120 times faster than with the Fay and Morlan device. But, as with size sexing of small numbers of pupae, these separators depend on the continuous production of uniform size pupae with no overlap of sizes between sexes.

The second basis of separation is the morphological difference between male and female pupae. In work with 8 common species representing 5 genera, Moorefield (1951) sexed pupae by noting differences in the genital segment. These determinations were verified by separating and rearing pupae and sexing of the adult. Once the morphological differences are recognized, the sexing of pupae becomes comparatively simple. With practice, sex determinations can be made at a glance regardless of the angle at which the hypopygium is viewed. The difficulty in this technique is that partial immobilization of the pupa is necessary in order to view the genital structures.

Moorefield (1951) suggested a technique for manipulating and sexing pupae. This essentially involves the use of a medicine dropper with its tapered end cut off. The pupa is drawn in with a column of water. It eventually moves to either the lower or upper meniscus. While the pupa is at rest in the meniscus the pipette may be carefully manipulated and the pupa sexed. Very careful handling is required, since even slight jarring causes a movement of the pupa.

Gillett (1955) reported a 'dry' method in which pupae were placed on moist paper and immobilized enough to be sexed. Ingram (1954) reported that viable adults resulted from pupae reared under these conditions.

Another procedure found effective for sexing live pupae also involved the use of a blunt end medicine dropper. The pupa is drawn into the pipette with a minimum of water. As much water as possible is squeezed out. The pipette is then quickly tilted backwards towards the rubber tip and the pupa remains on the inner wall. The pipette can be easily and rapidly manipulated. The pupa is surrounded by a drop of water so that it is safe from desiccation. Yet, the movement of the pupa is curtailed enough so that sexing can be accomplished easily. The effectiveness and speed of this procedure is determined by the ability to recognize the hypopygium at any angle.

In summary, the above technique improves Moorefield's method by increasing the ease of manipulation of the pupa. As with other procedures based on differences of the genital segments, this method is limited by the number of pupae that can be processed per unit time.

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Stomoxys calcitrans (L.) Breeding Along TVA Reservoir Shorelines

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For a number of years the stable fly, *Stomoxys calcitrans* (L.), has plagued campers and fishermen in certain areas of Kentucky and Pickwick Reservoirs on the Tennessee River. The pain and discomfort caused by this biting fly have become so acute at times that groups of people have been forced to abandon camping and recreational facilities.

A 3-year study on the Kentucky Reservoir side of Land Between the Lakes has shown that large outbreaks there are associated with dead mayfly bodies, *Hexagenia bilineata* (Say), and reservoir water levels. Kentucky Reservoir water levels follow an established guide curve, but flood control operations occasionally require temporary deviations. In June 1966 when water level recession started, a moist windrow of fine flotage mixed with mayfly bodies was left undisturbed by the receding water. This provided a suitable breeding situation for the stable fly (Fig. 1). On the other hand, an upward fluctuation of the reservoir water level at the proper time and amount could flood and destroy the fly larvae. In 1967 the production was minimized due to such upward fluctuations.

Figure 2 shows the relationship of *Stomoxys* outbreaks to mayfly emergence and water level operations. Nuisance populations of stable flies occurred 28, 21, 16, and 27 days, respectively, after heavy mayfly emergence, with some overlapping at the end of the season.

In 1966, the first brood of mayflies emerged about June 15, and the stable flies reached the peak of their biting activity 28 days later. By this time the lake level had been lowered approximately 1 foot. The other outbreaks which occurred appear to be correlated with other mayfly broods and continued water level recession.

FIG. 1.—*Stomoxys calcitrans* breeding habitat, Kentucky Reservoir, August 24, 1965, resulting from receding water which deposited fine flotage and dead mayflies in a protected embayment.

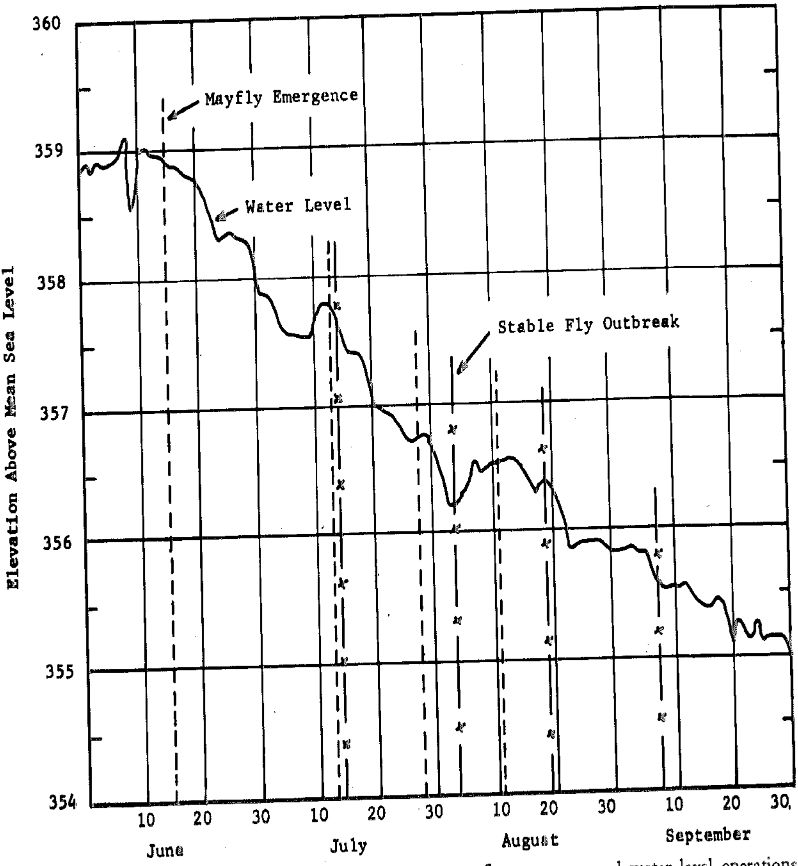

FIG. 2.—Relationship of *Stomoxys calcitrans* outbreak to mayfly emergence and water level operations.

Another source of stable fly breeding was found to be in accumulations of dead mayfly bodies under security lights in recreational areas adjacent to the reservoir. Twelve days after the mayflies accumulated, stable fly larvae and puparia were found. In about 20 days the adult fly numbers reached their peak.

THE SILENT SUPERVISOR [1]
(A FUNCTIONAL ORGANIZATION CHART)

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A need arose in the Desplaines Valley Mosquito Abatement District to know where every man and every piece of equipment was located during working hours. The problem was attacked by first making an organization chart. A chart was constructed showing the district divided into eight departments, thereby adhering to the accepted practice of management of a maximum of eight subordinates reporting to one supervisor. Once the organization chart had established the lines of authority and working divisions, it was a simple matter to add names of individuals and vehicle numbers.

According to the organization, the foreman has supervision of 1—clerical, 2—laboratory (it was found that the manager actually assumed this responsibility of supervising the clerical and laboratory personnel due to the physical structure of our office), 3—pollution, 4—north section, 5—central section, 6—south section (the 76 square miles within the district was divided as equally as possible taking into consideration the amount of work in each area), 7—fogging and ditching and, 8—shop.

Under each section individual removable name tags are placed on pegs for work assignments. Added to the name tag is the vehicle number tag. This system gives management an immediate location of men and equipment. The employees designated as night foggers are assigned to a labor pool and are assigned daily to specific jobs when not actually fogging.

On the bottom edge of the chart and directly beneath each section is a spring clip where each section foreman writes down pertinent data for the general foreman and night garage man. He notes the location of his starting point, where he will stop for lunch, and the kind of insecticide and amount he will need for the next day's operation. This is usually done during the last 10 minutes of the day when the section foremen gather at the chart. Here, too, they may receive notices or instructions left on their clip by the general foreman. We found that this procedure reduced the amount of overtime hertofore required by the day men to fill their own trucks. Under this program the night garage man fills insecticide tanks, gasoline tanks and checks out the vehicles. Everything is ready for the field crews by 8:30 the following morning.

The silent supervisor makes it possible for management to locate men and equipment within just a few minutes. It is also a valuable tool when answering complaints to know what insecticide is being used, when it is being used and where it is being used.

We have reduced the time necessary to locate men and equipment.

The Silent Supervisor doesn't say anything but can answer most of the questions asked by management.

[1] Presented at the annual meeting of the American Mosquito Control Association, March 31–April 3, 1968, New Orleans, La.

THE INTERCEPTION OF LIVING LARVAE OF *Aedes aegypti* (L.) AND *Culex cinerellus* EDW. IN AIRCRAFT

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Living mosquito larvae were collected recently in an aircraft arriving from overseas. Literature pertaining to the accidental transportation of insects in ships and aircraft is extensive and will not be reviewed here. Suffice it to say that interceptions of living mosquito larvae in aircraft have been rare.

On 2 May 1968, a Military Air Command aircraft arrived at Forbes Air Force Base, Kansas, directly from overseas. The plane had departed Charleston, South Carolina on 28 April, with intermediate stops in Surinam, Liberia, and the Azores. Inspection of the aircraft revealed 16 living mosquito larvae in water that had accumulated on a tarpaulin used as cover for cargo. The covered cargo had been stored on pallets, in an open area in Liberia, for some time prior to loading on the aircraft.

The larvae were reared at Forbes AFB and adults emerged on 11–12 May. The adult specimens were sent to the USAF Epidemiological Laboratory where they were identified as seven female and five male *Aedes aegypti* and one female and three males of an unknown species of *Culex*. Dr. Alan Stone, Systematic Entomology Laboratory, U. S. Department of Agriculture, Washington, D.C., confirmed the *Ae. aegypti* determination and identified the *Culex* as *C. cinerellus*, a species found in West Africa. This is apparently the first time that living larvae of these two species of mosquitoes have been found in aircraft entering the United States.

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