APPARATUS FOR THE CHRONOMETRIC COLLECTION OF EMERGING MOSQUITOES

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Experimental protocols that require the use of adult insects whose chronological ages must be known within a few minutes or hours, and whose pre-adult stages are aquatic, present special problems to the investigator. Most methods for obtaining insects, such as mosquitoes, of known ages are relatively labor-intensive and often require large insect populations and/or elaborate rearing schedules in order to obtain the desired number of individuals of the required ages.

The device described here automates much of the process, thereby permitting us to obtain the desired insects at a considerable saving in time and money. The apparatus was constructed of materials usually available in the laboratory and shop. In principle, the system is similar to a fraction collector used in biochemistry laboratories. At programmed intervals, a turntable rotates a preset distance between alignments of collecting containers over an emergence container. In our system, the turntable base was made of ½ inch plywood and the turntable of ¼ inch acrylic plastic. A variable-speed motor (Bodine NSH-3312 motor with a Minarik Electric Co. Variable Speed Controller, Model SH-32 or equivalent) set to operate at 4 to 6 RPM, a timer circuit (described below), a series of small collection cages, and a

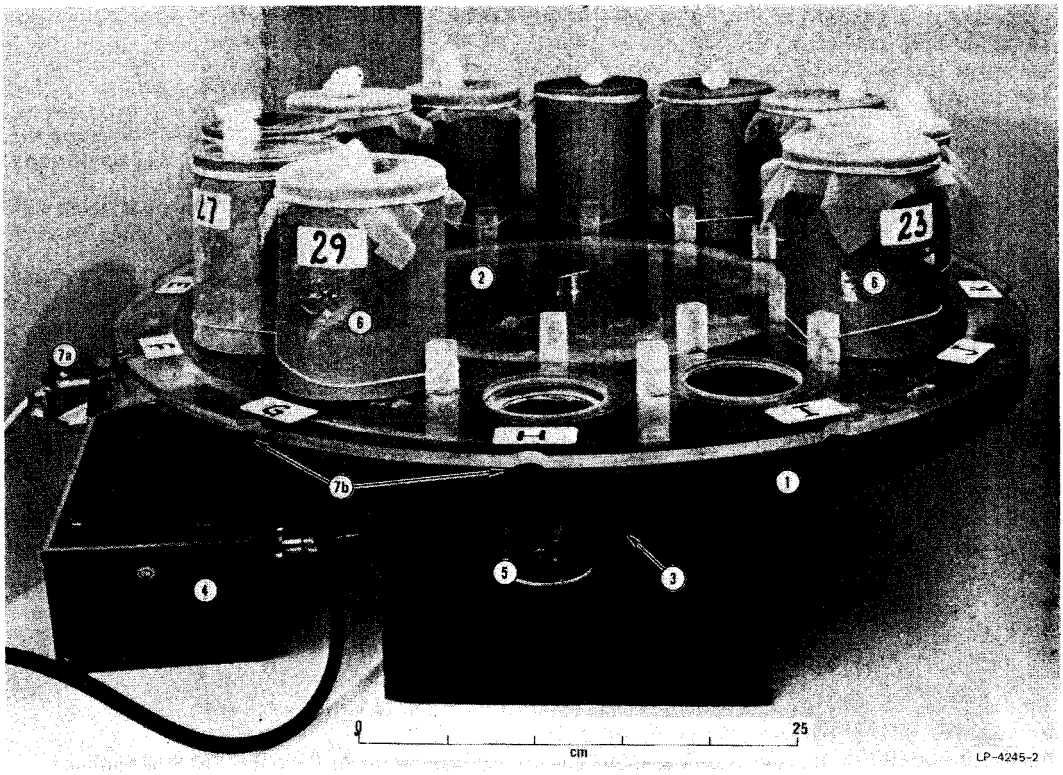

Fig. 1. Apparatus for the chronometric collection of emerging mosquitoes. 1—Turntable base; 2—Turntable; 3—Motor (inside base); 4—Motor control; 5—Beaker with mosquito larvae; 6—Collection cages (12 positions; 2 removed to show opening in both turntable and base with beaker (No. 5) at one position. All other cage positions have openings only through the turntable); 7a—Turntable alignment switch (microswitch with roller on end of lever arm) and 7b—Detents (notches) in edge of turntable at each collection cage position.

100-ml beaker containing mosquito pupae complete the list of major components. The apparatus is illustrated in Fig. 1.

The basic timing diagram is shown in Fig. 2A. Figure 2B shows the actual timing diagram that was employed using the components in Fig. 2C. The "collection period timer" used was an AMF Paragon 24 h Timer having 15 min setting capability, i.e., 48 separate on-off operations per 24 hr and an output of 110 VAC. A 110-VAC SPST relay was used to convert this to a switch closure to start the 1 sec "Start" timer (in our system, a Hunter model 120 timer). The 1 sec timer started the turntable motor. As the turntable began to rotate, a microswitch with a lever arm riding on the edge of the turntable was closed. This maintained current to the turntable motor after the 1 sec timer had finished its cycle. When the next cage was aligned with the beaker of pupae, a detent (notch) in the edge of the turntable allowed the "Turntable Alignment Switch" to open, thereby turning off the turntable motor. Other timer devices, such as the Chronotrol™ programmable lab timer or a Graylab™ Model 451 timer available from most laboratory supply companies, might also perform the required functions. A variable-speed motor is not required if the turntable speed is maintained between 4 to 6 RPM.

Several other things should be considered when assembling the system. The surface on which the turntable slides must be smooth to reduce friction so that a small, inexpensive motor may be used. The motor speed should be fast enough to overcome friction but not so fast that it prevents the turntable alignment switch from turning off the motor. For proper alignment of the turntable, the coasting time of the motor after it is turned off must be considered. The start timer interval must be long enough to allow the turntable's rotation to close the Turntable Alignment Switch.

The beaker (Corning 1040 beaker without spout, or equivalent) containing the pupae is placed through a 51 mm hole in the turntable base so that it is suspended from its rim. The water level is brought up to the rim to reduce

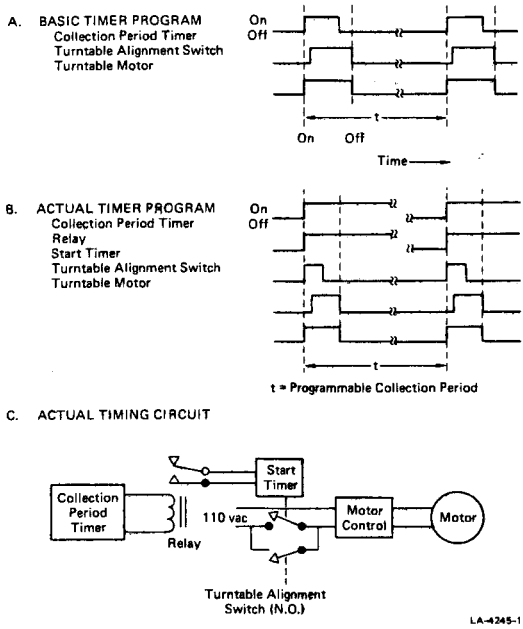

Fig. 2. Time interval patterns and timer circuit.

the air space so that the emerging mosquitoes must enter the collection cage above.

The collection cages can be fabricated either from 1 pint (0.47 liter) cylindrical cardboard ice cream containers or from the cores (86 mm outside diameter) obtained from the paper rolls used in some photocopying machines. I prefer the latter because of their durability. The cores are cut into two 106 mm long cylinders, and mosquito netting is held over the top with tape or rubber bands. The bottoms of the cages are the bottoms of 9 cm, disposable plastic petri dishes lined with a layer of laboratory tissue paper. Twelve of these cages without their bottoms are placed on the turntable over each of the 60 mm diameter holes and held in place with rubber bands. To remove the cages when they contain mosquitoes, the rubber band holding the cage in place is removed, and a 3 × 5 inch (75 × 127 mm) index card is slipped between the cage and the turntable. The collection cage, with the card covering the open bottom, can then be lifted off the turntable and placed over the petri dish bottom. The index card is slipped out and the cage is fitted snuggly into the petri dish.

This system has been successfully used in my laboratory for over 6 months and has provided several thousand mosquitoes whose ages were determined to within ± one-half the collection period. Collections over weekends require only that empty cages are in place on the turntable on Friday afternoon in order to not have overlapping collection intervals before noon on the following Monday. A raisin or sugar cube and a water-soaked cotton ball placed on the mosquito netting on top of the cages provided sustenance for the mosquitoes for 2 to 3 days.

EDITORIAL NOTICE—SCIENTIFIC NAMES

The scientific name of a species should be spelled out in its entirety the first time it is used in a title, abstract or the text. Thereafter, the appropriate generic abbreviation may be used after the initial citation of a species. The one exception is that sentences should commence with the complete generic name. Subgeneric names do not need to be mentioned unless an author wishes to make significant comparisons between different subgenera.

Names of authors of species are not used in either the title or the abstract. In the text, they should only be mentioned the first time a species is cited. The names of well-known authors may be abbreviated as follows: Coquillett = Coq., Fabricius = Fabr., Linnaeus = Linn. and Wiedemann = Wied.

Current nomenclature for mosquitoes of North America, north of Mexico can be found in the Darsie-Ward key (1981). For other areas, consult the Knight-Stone mosquito catalog (1977) and its supplement (Knight 1978).

Abbreviations for genera of Culicidae commonly mentioned in *Mosquito News* follows [the complete list may be found in *Mosquito News* 40:431 (1980)]:

Aedes = *Ae.*
Anopheles = *An.*
Armigeres = *Ar.*
Coquillettidia = *Cq.*
Culex = *Cx.*
Culiseta = *Cs.*
Deinocerites = *De.*
Limatus = *Li.*
Mansonia = *Ma.*
Orthopodomyia = *Or.*
Psorophora = *Ps.*
Sabethes = *Sa.*
Toxorhynchites = *Tx.*
Trichoprosopon = *Tr.*
Tripteroides = *Tp.*
Uranotaenia = *Ur.*
Wyeomyia = *Wy.*

It is not necessary to use 'Diptera: Culicidae' in the title or a footnote. However, it may be useful to use 'Diptera: Ceratopogonidae', etc. for other families of biting flies.