generally given more difficulties than that of *An. gambiae* in the insectaries of the London School of Hygiene and Tropical Medicine (C. F. Curtis, personal communication).

A similar cage as here described may facilitate the colonization of other species as well. For instance, some "dancing" was observed in this cage in pilot experiments with males of *An. funestus* Giles, a species notoriously difficult to breed. Some success at least could be expected with this medically important mosquito since it was seen to form swarms in the field in places and at times that partly overlap with those of *An. gambiae* and *An. arabiensis* (Marchand, unpublished data). For successful colonization of *An. funestus* however, the problems of rearing its larvae would have to be solved as well.

Another interesting application of this type of cage may arise in tests of genetic control methods for members of the *An. gambiae* complex. In field trials of genetic control with other mosquito species it is often found that the released males, when derived from laboratory colonies, are not fully competitive with wild males (Reisen et al. 1980, Grover et al. 1976, Milby et al. 1980). Laboratory adapted strains of *An. gambiae* (KWA, originating from Kwale in Tanzania and the R70 translocation strain (Curtis et al. 1976) with KWA genetic background, kindly supplied by C. F. Curtis of the London School of Hygiene and Tropical Medicine), when tested in the "swarm-cage" formed similar swarms as wild material. However, they obviously do not require the special visual cues to do so because they swarmed in all cage types, and even in complete darkness. A tendency of laboratory-adapted males to start swarming in the field at non-specific sites may diminish their competitiveness considerably. The cage would offer the possibility of breeding a laboratory population in which the mating behavior of the males is as near as possible to that of wild males. This reduced selection pressure would probably not hold for female behavior because the activity of wild females in this cage was still lower than that of females from laboratory adapted strains. Any genetic association between male and female mating behavior would, therefore, still imply changing male behavior during prolonged colonization in this cage. However, experiments (to be reported elsewhere) indicated that the behavioral difference between wild and adapted males is inherited from father to son and is possibly controlled by genes on the Y-chromosome.

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BEECOMIST SERVOFLO VARIABLE FLOW PUMPING SYSTEM: A PRELIMINARY REPORT

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In May 1984, it was decided to replace the insecticide delivery system on one of our old Leco machines. The pressure system, in spite of its relative simplicity, had a number of drawbacks, the main one being the routing of chemical into the cab of the spray vehicle. In June 1984, Beecomist introduced a new variable flow pumping system which utilized a modification of the positive displacement rotary piston pump. We purchased the first of these units (Model 101—Beecomist Systems, Inc., 31 Meetinghouse Road, Telford, PA 18969) and installed it in late June.

VARIABLE FLOW VERSUS CONSTANT FLOW. Many of the advantages of a variable flow pumping system are immediately obvious. Others are rather subtle, but also very important. The most important advantage of the variable flow system is that of avoiding overdosing. A constant volume system calibrated for 10 mph is overdosing by a factor of two if the vehicle slows to 5 mph. The concern for environmental contamination is an important one and a delivery of more chemical into the environment than is necessary to do the job must be avoided. Increasing the vehicle speed to 15 mph results in underdosing by a factor of 0.33. This may cause a reduction in mosquito control. In any event, either underdosing or overdosing results in the wasting of expensive chemicals. Another advantage of variable flow is that of increased area coverage by a single spray vehicle. Our experience indicates that a spray vehicle can cover as much as 80% more territory during the normal shift as a vehicle with a constant volume delivery system. Two vehicles equipped with variable flow can easily handle an area requiring three vehicles equipped with constant volume systems.

Vehicle operating efficiency is also greatly increased. Operating at 20 mph results in better gas mileage as well as reduced wear and tear on the vehicle. Operating a spray truck with an automatic transmission at 8–12 mph places the vehicle in a speed range which causes constant shifting of the transmission from low to middle gear. Operating the same vehicle at 15–20 mph will avoid this problem. Another advantage of the variable flow system (equipped with automatic, low-speed pump cut-off) is that the spray vehicle will become coated with much smaller amounts of insecticide. As a spray vehicle slows down, the rate of insecticide flow is reduced. The pump automatically shuts off before the vehicle stops. It is possible that with constant volume units, the driver forgets to cut off the pump as the vehicle stops. A few years ago we had a legal problem after one of our drivers left the pump running while the vehicle was stopped. This resulted in excessive insecticide deposit on a parked vehicle adjacent to the spray vehicle. Another important advantage of a variable delivery system is that the driver can concentrate on his driving and not be as concerned with turning the pump on and off.

In discussing the advantages of variable flow pumping systems, it would be remiss if possible disadvantages were not mentioned. Probably the most important point to consider is that *all* variable flow systems are more complex than constant flow systems. Repair of variable flow systems generally are beyond the capability of many mosquito control agencies, primarily because they utilize rather sophisticated electronic technology. Therefore, servicing becomes an important consideration.

Selection of the Beecomist variable flow system as the unit to use on our Leco was based on the fact that it utilizes the Fluid Metering piston pump identical to the pump used on our Whispermist sprayer (Beecomist Systems, Inc., 31 Meetinghouse Road, Telford, PA 18969). The Whispermist has been in service for four seasons with no pump problems. On the variable flow system, the pump is modified so that the piston stroke is varied with the speed of the spray vehicle.

DESCRIPTION OF SYSTEM. Signals are picked up from the vehicle transmission by a Sangamo transducer (Biomeasurement Systems, Inc. P.O. Box 150, Ambler, PA 19002). This is a Hall-effect transducer which provides 16 pulses per revolution of the speedometer cable. The speedometer cable is unscrewed from the transmission, a T-adapter is installed and the speedometer cable is reattached to one output of the T-adapter. The transducer is attached to the other output of the T-adapter. The frequency of the pulses produced by the transducer is proportional to vehicle speed. At 10 mph, 44.4 pulses per second are produced, while at 5 and 20 mph 22.2 and 88.8 pulses per second, respectively, are produced. These pulses are electronically processed to produce a fixed frequency pulse with a pulse length that varies proportionally to the input frequency. The slower the vehicle travels, the longer the pulse width, while conversely, the faster the vehicle travels, the shorter the pulse width. This information is fed into a pulse width modulated servo which, in turn, mechanically changes the piston stroke on the pump head to provide the correct chemical flow for a given vehicle speed.

The control unit has provisions for calibrating each of three channels so that three different chemical flow rates can be preprogrammed. Switching to any of the three programs is accomplished by means of a keyed switch. Once a given channel is selected, the key can be removed so that flow rate cannot be changed by unauthorized personnel.

Calibration is quite simple and is accomplished by means of an internal crystal oscillator. In calibrating, the crystal oscillator is set in the 5 mph position and a potentiometer is adjusted until the correct 5 mph rate is achieved. Then the crystal oscillator is set to the 20 mph position and another potentiometer is adjusted for the correct 20 mph rate. Once the two extremes (5 and 20 mph) are set, all rates between the extremes are proportionally set. Following calibration the switch is returned to the transducer position. There are a pair of potentiometers for calibrating each of the three channels.

Vehicle speed is indicated by a series of Light Emitting Diodes (LED's) on the front panel of the control box. The pump automatically shuts off at a speed below 3 mph and above 20 mph. At speeds above 20 mph, an audible alarm sounds, indicating to the driver that the pump has shut off. Pumping resumes when vehicle speed drops below 20 mph. The control box also has provisions for spraying while the vehicle is stopped. A red button on the front of the control box automatically starts the pump to deliver chemical at the 10 mph rate as long as it is depressed. The same button is used for flushing, if flushing is done, while the vehicle is stationary.

Since the transducer used in this system is identical to the one used with the Sangamo electronic tachograph, the tachograph can be used with the system. Provisions are made in the control box to pick up the transducer pulses for the tachograph. The tachograph we are using in our system was purchased from Biomeasurement Systems, Inc. (P.O. Box 150, Ambler, PA 19002) and was modified to record only sprayed mileage rather than total vehicle mileage.

A variable flow unit calibrated to pump 3 oz. of malathion per min, at the 10 mph rate, will deliver a total of 18 oz. per linear mile regardless of vehicle speed within the cut-off limits. Use of the tachograph with the system provides an excellent tool for monitoring accuracy of the chemical delivery system. For example, a vehicle accumulating 50 sprayed miles in one evening calibrated to give 18 oz. per sprayed mile should have sprayed 900 oz. of chemical in total. Dividing 900 by 128 (oz./gal) gives the number of gallons, namely, 7.03 gal. Measuring the chemical left in the tank on a daily basis provides an accurate check of system calibration.

Since installation, our Beecomist Servoflo System has logged over 128 hr of usage (almost 2,000 sprayed miles) with no downtime. Much more time would have been logged, however; a shortage of pesticide in August prevented additional hours of spraying. Operator reaction to the new pumping system was extremely favorable. Pump accuracy remained better than 98%. After initial calibration, no further calibration was necessary during the remainder of the season. We plan to install additional units including tachographs as funds become available.

GONOTROPHIC AGE, INSEMINATION, AND *ASCOGREGARINA* INFECTION IN A SOUTHERN WISCONSIN POPULATION OF *AEDES TRISERIATUS*

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During the summer and early fall of 1977, human bait catches of *Aedes triseriatus* (Say) were made in an area of southern Wisconsin endemic for La Crosse (LAC) encephalitis virus. The study was designed to characterize the host-seeking component of the *Ae. triseriatus* population with regard to gonotrophic age, proportion of mated nulliparous females and the percentage infected with the gregarine parasite, *Ascogregarina barretti* (Vavra). The data presented here were derived from dissection of 557 of 826 specimens captured. Some of the results have been cited (as unpublished data) in a number of previous papers, i.e., Miller et al. (1979), Miller and DeFoliart (1979), Scholl et al. (1979a, 1979b); Burkot and DeFoliart (1982), Mather and DeFoliart (1983), and DeFoliart (1983).

The series of catches was made in a forested area on the M.G. and R.P. Hanson farm 35 miles west of Madison. The catches were made at 2 sites within the forest and 2 at its edge. A 6 m wide mowed grass strip separated the forest edge from an abandoned field. The 2 edge sites were 73 m apart; the 2 sites within the forest were 78 and 120 m from the forest margin, and were 42 m apart.

In sampling, the time between sunrise and sunset was divided into 12 equal intervals, and the first 6 and the last 6 intervals were sampled on alternate days. All 4 sites were sampled for a 12-min period during each interval, thus, although the 12 intervals varied in length as the time from sunrise to sunset changed throughout the summer and fall, the sample periods were of constant duration. The order of sampling was determined using a random numbers table.

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