OPERATIONAL AND SCIENTIFIC NOTES

A SIMPLE METHOD FOR DETERMINING AIRPLANE SWATH PATTERN.—Since 1946 the Kern Mosquito Abatement District has been one of the pioneers in the use of aircraft for mosquito larval control in California (Geib 1946). During the early years only the most meager information was available for aircraft use in this specific type of operation, so pioneering was a matter of necessity rather than choice. In 1947, Magy, Dahl, et al., in cooperation with the Kern District, completed tests to determine swath width, mass medium droplet diameter, foliage penetration, etc. These tests were completed utilizing magnesium oxide coated microscope slides, which they floated on wooden blocks during the aircraft spraying. While results by this method of approach revealed the great over-all value of aircraft use for mosquito control in a variety of situations, it involved many man-hours' labor both in the field and laboratory before results could be fully ascertained.

This past season, the District had occasion to determine and compare the swath width of two different types of aircraft, and it was imperative that the work be completed in as short a period as possible, because of the limited availability of the planes. The time and man power involved in the use of magnesium coated slides was out of the question at that particular period, so an abbreviated method had to be decided upon. The simple technique finally employed worked so well that we felt the information should be passed on to others who may have occasion to make a similar evaluation.

The District had on hand a supply of fluorescine dye, surplus navy sea-marker, part of which had been used in tagging adult *Aedes nigromaculis* while checking their flight in 1955. In a hasty check in the laboratory the sea-marker showed up very well on white butcher paper in a 10 percent water solution. Without further evaluation, the swath comparison check was set up for the next morning, utilizing the dye as a marker and butcher paper as the paper indicator.

The dye was pre-mixed in 5-gallon containers before pumping into the spray tank of the aircraft, as sea-marker goes into solution very slowly at this dilution. Meanwhile, the butcher paper was unrolled to a 100-foot length across the airstrip and weighted down on the edges with small piles of sand every ten feet or so, depending on the velocity of the prevailing breeze.

After the pilot made a flight across the paper spraying at the rate of one gallon per acre, an observation of swath width and pattern was recorded immediately. The center position of the flying aircraft was marked on the paper so that any type of correction that might be necessary on the boom could be immediately pin-pointed by viewing the paper. After observation, the paper was cut off at both ends beyond the swath pattern to lessen the bulk. The paper was then rolled together from both ends and marked, while another was unrolled for the next run. By this method the swath pattern of the two airplanes making three replicate runs at three different elevations for a total of 18 runs was completed in less than two hours. Work was begun in the early morning when wind velocity was at a minimum. Some difficulty was experienced with the paper by occasional gusts; however, the flying aircraft did not disturb the paper even at an altitude of only 10 feet.

Since the time these runs were made, several pilots as well as other interested persons have unrolled the sheets to prove one point or another. An issue becomes very clear and leaves little room for argument when the entire 70 to 80 foot width is laid before them for observation and study.

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THE ABILITY OF THE TOP MINNOW, *Gambusia affinis* (Baird & Girard) TO REPRODUCE AND OVERWINTER IN AN OUTDOOR POND AT WINNIPEG, MANITOBA, CANADA.—Only one record was found of the top minnow, *Gambusia affinis,* being introduced into Canada for mosquito control (Mail 1954). The minnows were released in 1924 at Banff, Alberta into warm springs, and observations made in 1953 showed that they were still present. This was the farthest north that top minnows had been successfully established. There are no records of *G. affinis* being established in a climate as severe as that which prevails in Manitoba. The normal mean temperatures during the coldest winter months of December, January and February are 6.6°, —2.1° and 2.1° F., respectively. Temperatures as low as —35° F. are not uncommon. The normal means for the warmest summer months of June, July and August are 61.9°, 67.1° and 64.4° F., respectively.

Because of the many reports of successful introductions of top minnows into some of the more northern states of the U. S. A., it was thought that these fish might be able to survive the cold winters of Manitoba. In September 1957, the late Mr. E. J. Stansfield, field manager of the

Greater Winnipeg Mosquito Abatement District arranged to have approximately 150 top minnows shipped to Winnipeg from the Desplaines Valley Mosquito Abatement District in Chicago where they are used extensively for mosquito control. Trials were conducted at the Department of Entomology, University of Manitoba to test their cold hardiness and reproductive potential under natural conditions in this area.

In May 1958, fifty top minnows were released into a pond (about 40' x 80' x 6' deep) near the University of Manitoba. Within a month after their release a rapid increase in population was noted. Reproduction continued throughout the summer and by September there were an estimated 3,000 minnows in the pond. K. G. George of Harvard University states (in litt.) that there is no previous record of *G. affinis* reproducing in outdoor ponds in regions where average summer temperatures are as low as those in Winnipeg. A fairly heavy growth of water plants and an ample food supply in the form of small aquatic organisms made this pond an ideal breeding site for the fish.

In October 1958, about 1,000 top minnows were removed from the pond by use of a seine net and transferred to the laboratory. An estimated 2,000 minnows were left in the pond to test their ability to overwinter in this climate. Observations made during the seining operations showed that top minnows of all sizes were present, and that many of the females were fully distended with young. The fact that the females were entering the winter in this condition raised some doubt as to whether they could survive.

A survey of the pond made in late May 1959, after the ice had melted, showed that a good population of *G. affinis* had survived the winter and had begun to reproduce.

Gambusia affinis has for many years been an important tool in mosquito control programs in the U. S. A. If further overwintering trials definitely prove that top minnows can successfully overwinter in Manitoba, they would be very useful in mosquito control in permanent waters here. Indications are that the northern limit of their usefulness will be extended considerably in the near future.

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—David L. Smith, Assistant, Provincial Entomologist, Extension Service, Manitoba Department of Agriculture and Conservation, Winnipeg, Manitoba. This work was done while the author was employed as a research assistant in the Department of Entomology, University of Manitoba, Winnipeg, Manitoba.

A CAGE SUITABLE FOR HOLDING AND FEEDING BLOOD-SUCKING MOSQUITOES.—In order to ensure oviposition in laboratory colonies of certain mosquitoes it is essential for the females to have regular blood meals. Blood-feeding may be carried out either by offering a living animal or by using preserved blood. Details of some of the numerous methods by which these two operations may be performed are given by Peterson (1955) and Trembley (1955). The present note deals with the design of a cage unit suitable for holding mosquitoes and for feeding them on a living animal.

When a small mammal is used for feeding mosquitoes, it is generally immobilised by a restraining device such as a rack and placed inside the mosquito cage. However, this method is attended by several disadvantages: feeding may occur on the delicate tissues of eyes or nostrils with consequent irritation and possibly inflammation, while the operation of inserting and removing the animal is invariably accompanied by some escape of mosquitoes into the breeding room. A recent modification of the Casanges-type animal holder by Jones and Schelterna (1956) minimises these disadvantages though it is still necessary to insert and remove the caged animal and construction of the all-metal holder is not simple.

An alternative to the above method is to hold the animal external to the mosquito cage. In this case it is common practice to anaesthetise the animal with nembutal (Leeson, 1952, communication in Trembley, 1955) place it on top of the cage and allow the mosquitoes to feed through the intervening net or wire mesh. Although such a method is intrinsically simple, it has the disadvantage of requiring time and labour for the various operations (weighing, injecting, cleaning, recording, etc.) which are involved.

Modifications of this second method, involving an externally-held but unanaesthetised animal—generally a mammal or bird—are also used, particularly when the mosquitoes are confined to a small container which can be fixed on, or applied to, some part of the host animal. Such methods are seldom employed when the mosquitoes are confined to a large cage, though Nieschulz (1930) devised one technique by which an unanaesthetised guinea pig could be held and restrained on the top of a large mosquito cage. The cage described below belongs to the same category as the latter since the guinea pig is confined to a compartment separated from that containing the mosquitoes by a wire screen, and it is through the latter that feeding occurs. Among the advantages which it offers are the following: feeding does not occur on eyes or nostrils; no narcotisation is necessary; no escape of mosquitoes can occur; introduction and removal of the animal and also cleaning of the apparatus, is extremely simple and rapid.

The general construction of the cage is shown in Fig. 1. The dimensions can be altered to suit individual requirements; those given in the figures are intended to serve merely as a guide. Basically the device consists of a cubical wood cage with half glass front, nylon net sides and top, and a wire mesh tunnel (15 holes per inch) running from front to back and fixed to the floor of the