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.

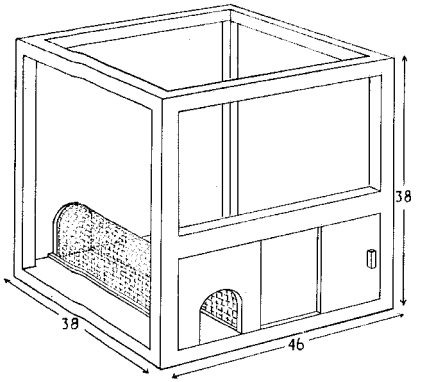
A CAGE SUITABLE FOR HOLDING AND FEEDING BLOOD-SUCKING MOSQUITOES.—In order to ensure oviposition in laboratory colonies of certain mosquitoes it is essential for the females to have regular blood meals. Blood-feeding may be carried out either by offering a living animal or by using preserved blood. Details 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



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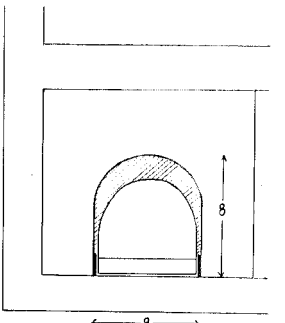

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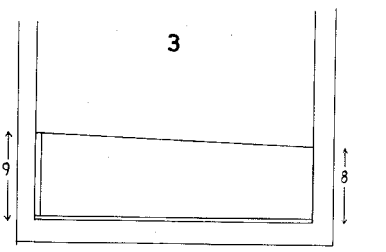

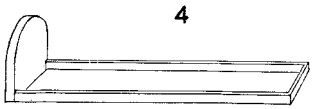

FIGS. 1–4.—Mosquito holding and feeding cage. 1. General view of cage. 2. Aperture to wire mesh tunnel with tray *in situ*. 3. Wood tray with vertical stop at rear end. 4. Side view of wire mesh tunnel in position in cage. (Dimensions given in centimetres.)

cage by wood strips. The wire mesh tunnel slopes towards the front of the cage and opens by an aperture which is 1 to 2 cm. higher than the maximum diameter of an adult guinea pig (Fig. 2). To operate, the wood tray (Fig. 3) with vertical stop at the rear, is inserted half-way into the tunnel and a guinea pig introduced to the aperture. When the animal has entered—which it will do readily—the tray is pushed fully into the tunnel and raised by inserting plywood strips beneath it. Strips of various thickness can be kept for this purpose: useful sizes are 4, 6 and 10 mm. The slope of the tunnel ensures that the animal's back, on which the mosquitoes feed, is in close contact with the wire mesh, it prevents compression of the thorax and also prevents the animal moving back towards the tunnel entrance. Faeces and urine are deposited in the tray. To remove the guinea pig it is merely necessary to extract the plywood strips (holes can be cut at one end to facilitate this) and withdraw tray and animal. In operation, it requires about 30 seconds to insert the animal and 10 seconds to remove it—and the tray is the only part requiring regular cleaning.

This type of cage has been successfully used for over a year in maintaining laboratory colonies of insecticide-resistant *Anopheles gambiae* Giles and has also been tried successfully with *Aedes aegypti* L.

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AN IMPROVED DIET FOR INSECTARY REARING OF *Anopheles quadrimaculatus* SAY.—For several years *Anopheles quadrimaculatus* mosquito larvae were reared successfully on powdered dog biscuit following the technique used by Crowell (1940), but at various times trouble developed, due possibly to formula changes in the dog food, and the weak pupae that emerged barely kept the colony alive.

In 1958, through a trial and error screening method in search of a better diet, it was learned that a powdered beef liver extract produced the strongest and healthiest larvae ever reared in the insectary. Some of these larvae had the white stripe down their back that is commonly seen