peeled sapling, rough cut stakes, a piece of bamboo or an adjustable metal tent pole—each will serve well.

The principal element of the trap, the canopy, is made of 4 mil polyethylene plastic cut as 4 equilateral triangles and machine-sewed at the sides to form a large open-topped pyramid (Fig. 1). An apron of black polyethylene plastic is sewed over the lower portion of this pyramid. The open top of the pyramid is supported by a wooden or metal ring made from an embroidery hoop (2 telescoping hoops with about 7" diameters) taped or sewed in place to form an upper collar for the canopy (Fig. 2). Two wire support rods, made from coat hangers, are bent and attached to the hoop to form a tight central loop (Fig. 2). A headless nail driven part way into the upper end of the support pole holds the hoop and the attached canopy in position (Fig. 3). Grommets were fixed at each corner of the canopy and a 4' guy rope attached to each. Approximate trap dimensions are given in Figure 4.

The total cost of the material involved is about $5 and sewing the canopy and attaching the collar, grommets and guy ropes takes about one hour. Canopy, cage and pole weigh less than 5 pounds allowing one person to carry four traps easily over rough terrain.

TRAP EFFECTIVENESS. These canopy traps have been used with dramatic success in collecting tabanids over two seasons in Delaware. Dry ice-baited traps captured as many as 1000 tabanids per hour during peak seasons. The dry ice (3–5 lbs.) was hung in a net bag from the top of the support pole. Unbaited traps captured about 300 flies per hour during the same peak periods of activity.

Mosquitoes, punkies, snipeflies, blackflies and stable flies also were captured in large numbers in such canopy traps.

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A METHOD FOR PROVIDING PERSONAL PROTECTION AGAINST SIMULIIDS

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While working at Steen River in northern Alberta during July and August, 1961, the author found that a thin film of fuel oil smeared over the outer surface of an unpainted, aluminum hard hat reduced to almost zero the number of simuliids attacking and biting the wearer. The blackflies appeared to be secondarily attracted to the shiny, silver color of an aluminum hard hat. As soon as their wings or bodies touched the fuel oil film, they were immediately trapped and killed. A cloth soaked in fuel oil and wiped over the hard hat left a sufficient film to trap the simuliids. Depending upon the density of blackflies it was sometimes necessary to use the same cloth to wipe off the layer of accumulated flies while at the same time applying a new coat of fuel oil.

Comparisons (no quantitative measurements) were made of the relative attractiveness to simuliids of 1) unpainted aluminum, 2) white fibreglas and 3) green fibreglas hard hats (all fuel oil smeared) which were worn separately by three different persons. Although approximately the same number of flies were attracted to each person, the aluminum hard hat caught the greatest number of blackflies with only a few on the white and almost none on the green.

This method of protection was not effective against the culicids in the area.

A COMPARISON OF LIGHT TRAPS AND LARVAL SURVEYS TO MEASURE MOSQUITO ABUNDANCE

KENNETH L. MINSON,[1] JAY E. GRAHAM [1] AND GLEN C. COLLETT [2]

Aedes vexans (Meigen) invaded Salt Lake City from areas south of the city in 1938 (Rees 1939) and it was an abundant species in Salt Lake County when the first comprehensive study of mosquitoes in Utah was made (Rees 1943). Urbanization of areas containing *A. vexans* habitats proceeded rapidly after World War II and by 1958 it was reported to be declining (Graham, Rees and Nielsen, 1958). Larval populations in the South Salt Lake County Mosquito Abatement District from 1956 through 1962 were low and no nuisances of any consequence were reported.

Populations, as measured by larval surveys, began to increase in 1963 and continued to increase through 1968, a period of 6 years. In 1969 there was a slight reduction from 1968 but this is now thought to be a leveling of the population. These increases were reported by Minson and Graham (1967, 1968). All the available evidence indicated that the species was increasing by changing its larval habitat from the shaded stream-side sites to open pastures. Neilsen (personal comm.) reports that *A. vexans* had been

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found in such habitats for many years in Salt Lake County. The change from 1963 through 1969 was not from a habitat where the species had never occurred but rather, was a great increase in abundance in areas where previously it had been rare.

Various kinds of traps and biting counts are used for adult population measurements. Both the Salt Lake City and the Salt Lake County Mosquito Abatement Districts use standard New Jersey light traps.

In areas like Salt Lake County which have effective larval control programs, measurements of adult populations are made on that fraction of the total potential population which survived larval control. This introduces additional complexities into the interpretation of data for several reasons. Among them are the bias resulting from areas in the vicinity of the trap receiving better control and the unevenness of control which occurs in all districts. Determination of population trends from the remnants of populations left after control is extremely difficult.

In 1956 the Salt Lake County Mosquito Abatement District began a detailed and extensive larval survey program and was joined a few years later by the Salt Lake City district. The procedures of the survey have been reported previously (Graham 1959); every positive larval source found is sampled. In the Salt Lake County District the number of positive sources afforded a reliable index of relative populations, but in the Salt Lake City Mosquito Abatement District mosquito larval habitats were of such a nature that the development of a similar index was impossible. Nevertheless the survey gave valuable information about populations although years of experience and constant improvement under the direction of a statistician were necessary to reach the present level of reliability of the data.

The relative sensitivity of our larval surveys and light trap catches in measuring overall changes in mosquito populations is indicated in the changes in populations of *A. vexans* over the past several years. Fig. 1 shows the increase in *A. vexans* populations in Salt Lake County

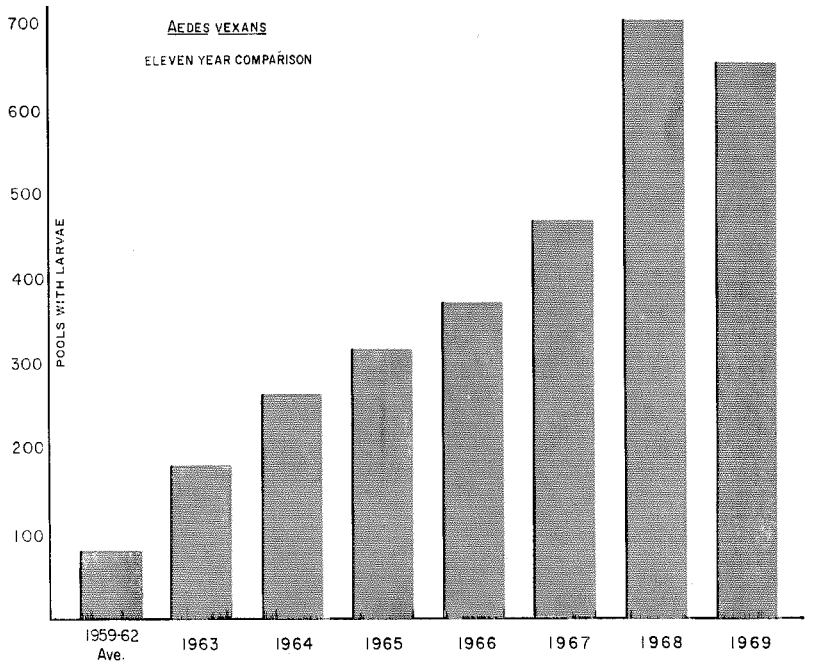

FIG. 1.—*Aedes vexans* populations from 1963 to 1969 as shown by larval survey procedures.

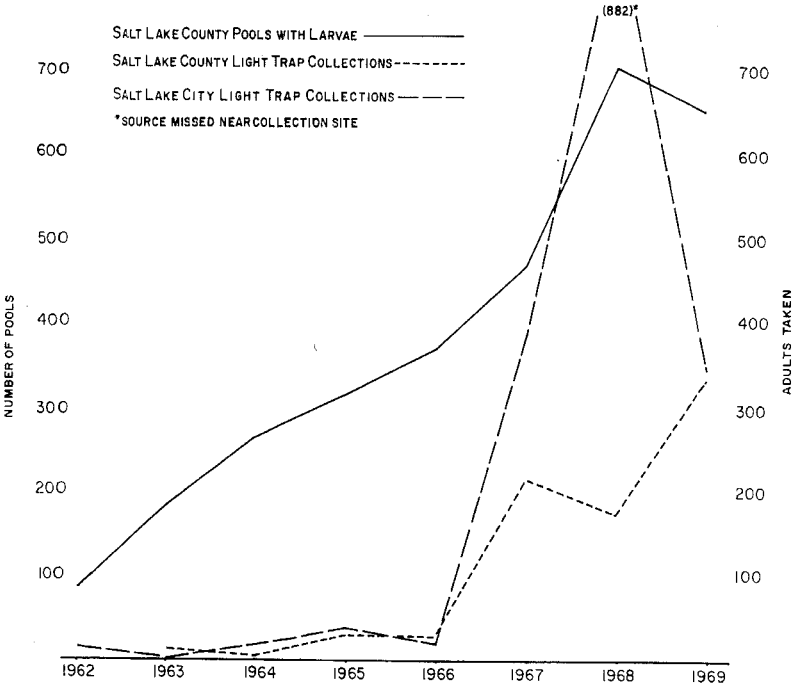

FIG. 2.—Comparison of *Aedes vexans* populations as shown by larval survey data and light trap collections.

which began in 1963 and apparently reached a new level in 1968, as shown by larval survey procedures. Fig. 2 compares larval survey data on *A. vexans* in Salt Lake County with light trap data on this species in both the Salt Lake City and the Salt Lake County districts. Light traps did not indicate an increase until several years after the larval survey had done so. This may be partly due to the impracticability of operating enough light traps adequately to sample every part of the district. Also, areas near traps are likely to get special attention since traps are used partly to evaluate control effectiveness and workers sometimes concentrate greater effort around them.

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