# FIELD EVALUATION OF THE CONCENTRATOR-DIPPER TECHNIQUE FOR SAMPLING MOSQUITO LARVAE

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Mosquito control in California is largely dependent upon aircraft application of insecticides to breeding or resting sites. To carry on this operation effectively, it is important to make an accurate estimation of the population density as well as patterns of distribution.

A great deal of effort has been spent by many workers to obtain unbiased data with minimum cost. The device most widely used for surveying adult mosquito populations is probably the light trap, although there are some controversies about the use of traps (Huffaker and Back, 1943; Provost, 1959; Barr *et al.*, 1963). For larval surveillance, many devices and methods have been utilized (Yamaguchi, 1952; Knight, 1964). The dipper method is used by many mosquito control agencies because it is simple and fast; however, this method has disadvantages as it is difficult to use in shallow water and dense vegetation and is not standardized.

In order to obtain less biased and more standardized samples of larval density with dipping, Husbands (1969) has developed a larval concentrator (Figure 1). It consists of a funnel attached to a brass tee by a hinge. A screen vial is placed in the brass tee and the water from the breeding site is dipped into the funnel; the larvae are concentrated in the screen vial.

This report compares field evaluations of the concentrator-dipper method with the conventional dipper method used in conjunction with a medicine dropper to remove larvae from the dipper.

MATERIALS AND METHODS. In order to evaluate the operational usefulness of the larval concentrator, ten dipping stations were randomly selected at each breeding site. Two inspectors collected samples from the stations by the concentrator-dipper and by the medicine dropper-dipper methods; two samples were taken by each inspector from each station, using alternating techniques. Collections were placed in glass vials containing 50 percent isopropyl alcohol.

A record was kept of sampling stations, the time required to take each sample, and methods used by each inspector. Collections were brought back to the laboratory for identification. The number of larvae per sample and the developmental stages were recorded.

RESULTS AND DISCUSSION. A comparison of the collections of *Culiseta inornata* (Williston) obtained by the two methods is illustrated in Figure 2, which shows a close relationship between these methods for population density as well as population composition (developmental stages and species). The collection data shown in Figure 2A were obtained at the end of March, 1969; first instar larvae were the most abundant in the collection and 2nd, 3rd, and 4th instars followed respectively; no pupae were collected. The data shown in Figure 2B were obtained at the same sampling site about a week later; at this time, 4th instar larvae were predominant in the pond. The data illustrated in Figure 2C were obtained on the same day as the latter sample but from an adjacent pond. The population index and its composition estimated bv the two methods agreed surprisingly well.

A comparison of the time required to make a collection (10 dips/site) by each method is shown in Figure 3. The time required for the medicine dropper—dipper

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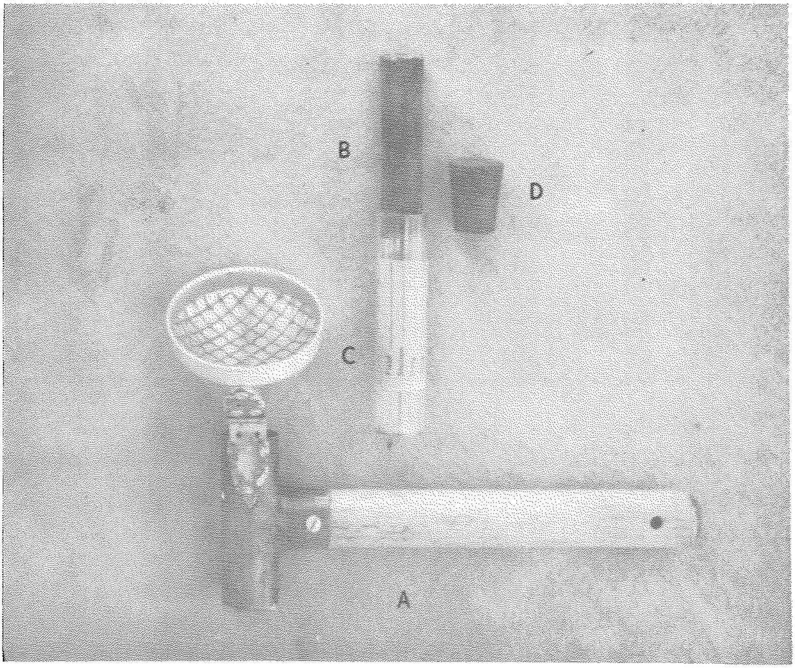


FIG. 1.—Components of the larval concentrator showing A, concentrator; B, collecting screen vial; C, holding glass vial; D, rubber stopper.

method was directly related to the number of mosquitoes collected. The correlation coefficient (r) of time required and number of mosquitoes collected per 10 dips with the medicine dropper–dipper method is 0.716, which is significant at the 0.05 level. Whereas, by the concentrator–dipper method, the time required was not influenced by the number of mosquitoes collected; on one occasion, 122 mosquitoes were collected per 10 dips in less than 4 minutes, while on another occasion 6.10 minutes were spent in order to get 14 larvae. There was no correlation between the time required to accomplish 10 dippings and the number of mosquitoes collected by this method (r=—0.510).

The mean time required to accomplish a dip by the concentrator–dipper method was 31.4 seconds, ranging from 16 to 66 seconds; the mean by the medicine dropper–dipper method was 95.25 seconds, ranging from 34 to 175 seconds. The difference between these means is highly significant (Table 1).

The time required to accomplish a dip with either method varied between inspectors; however, the differences were not significant at the 0.05 level (Table 1).

Operationally, the concentrator–dipper method has been used by the Fresno Westside Mosquito Abatement District since 1967 (Reed and Husbands 1969). During the years of 1965 and 1966, prior to the utilization of the concentrator, it was possible to devote only one day a week to sampling, while during 1967 and 1968 seasons, utilizing the concentrator, it was possible to make a collection daily with each inspection. Furthermore, these intensive larval surveillances with the new technique have coincided with a reduction of the total acreage treated.

In 1969, a flood disaster situation in

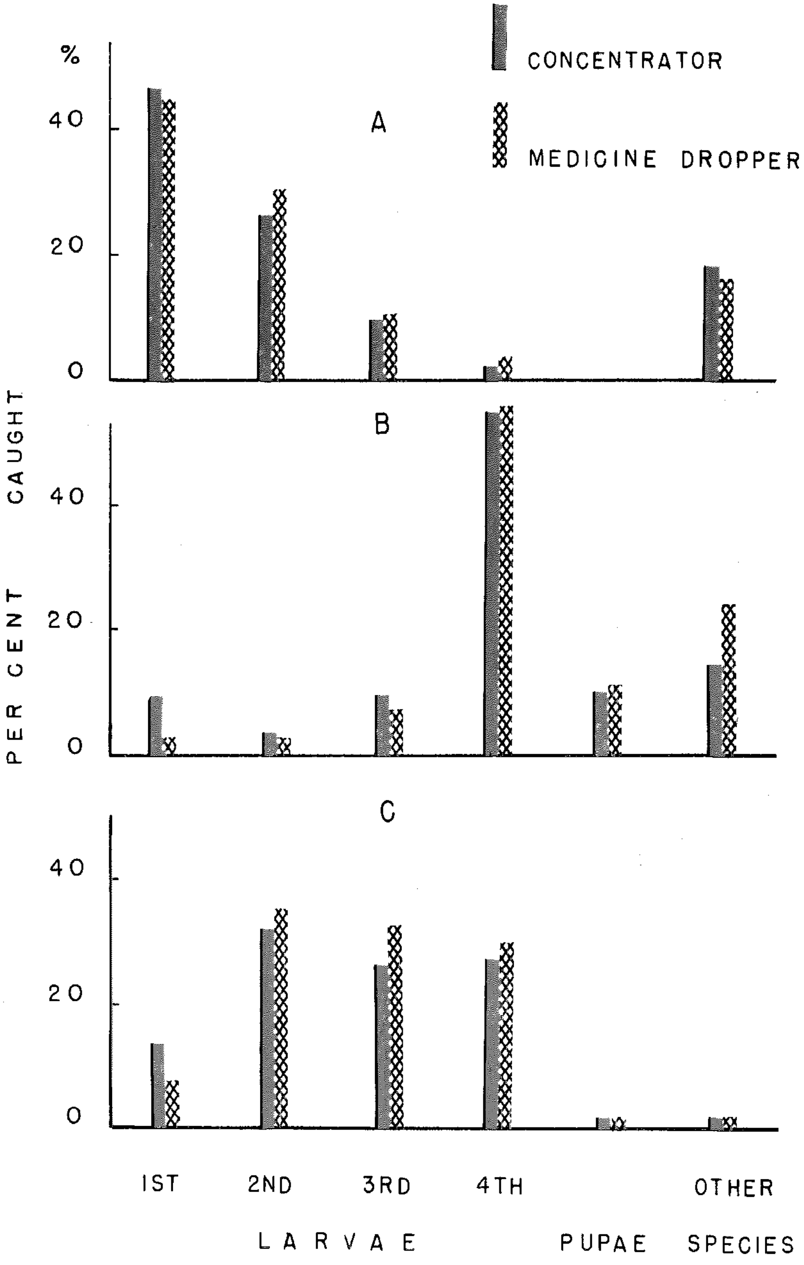


FIG. 2.—Comparisons of *Culiseta inornata* collections obtained on three occasions by larval concentrator and medicine dropper technique.

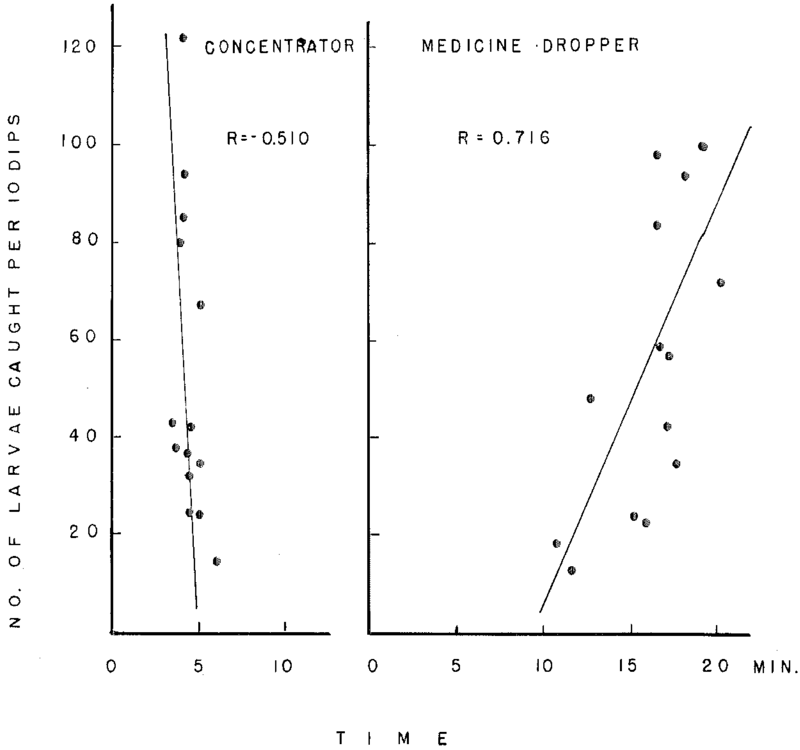


FIG. 3.—Scatter diagrams showing relationship between the time spent and number of larvae caught (*C. inornata*) by two collecting methods—dipper and concentrator; dipper and medicine dropper.

TABLE 1.—Analysis of variance of time required to accomplish a dip by the two collecting methods and by two inspectors.[a]

| Source of variation | d.f. | SS | MS | F |
|---|---|---|---|---|
| Concentrator vs. medicine dropper | 1 | 40768.28 | 40768.28 | 35.75 ** |
| Inspector A vs. Inspector B (concentrator-dipper) | 1 | 231.20 | 231.20 | 0.21 N.S. |
| Inspector A vs. Inspector B (medicine dropper-dipper) | 1 | 551.25 | 551.25 | 0.48 N.S. |
| Error | 36 | 41074.10 | 1140.95 | |
| Total | 39 | 82624.83 | | |

[a] The symbols used denote: d.f., degrees of freedom; SS, sum of squares; MS, mean square; ** significant at .001 probability level; N.S., not significant.

California created an urgent need for a great increase in mosquito surveillance and control programs. Helicopters were used extensively for larval surveillance. When used in conjunction with the concentrator, approximately 20 to 30 square miles were inspected per hour depending upon the number of sources.

SUMMARY AND CONCLUSION. The mosquito larval-concentrator devised by Husbands (1969) was evaluated against the conventional medicine dropper technique; it has been shown that the new technique is nearly three times faster in operation and that samples collected by the two methods agree in species composition as well as in numbers of each developmental stage.

This new method is an especially useful device for mosquito control agencies. By using the larval-concentrator, which reduced the time spent on each collection, the Fresno Westside Mosquito Abatement District was able to expand its program and nearly quintuple the total number of samples.

When used in conjunction with larval surveillance by helicopter, the new technique increased the efficiency of inspections and greatly reduced the cost per sample.

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# CROSS-OVER SUPPRESSORS AND STERILITY IN THE YELLOW FEVER MOSQUITO, *AEDES AEGYPTI*

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INTRODUCTION. Translocations have often been proposed as possible means for genetic control of insect populations because of the semisterility associated with them (Serebrovskii, 1940; Burnham, 1962; Rai and Asman, 1968; Laven, 1969). On the other hand, inversions, based on the massive data accumulated on *Drosophila,* have not been considered as possible candidates for genetic control because they are not usually associated with a high degree of sterility. Evidence reported herein associates two sex-linked cross-over suppressors, which are perhaps inversions, and a "cross-over suppressor-enhancer system" with semisterility in the yellow fever mosquito, *Aedes aegypti.* Their possible use as tools for genetic control is discussed.

Two sex-linked mutant strains, bronze body, designated as *bz* (Bhalla and Craig, 1967) and white eye, designated as *w* (Bhalla, 1968), and a wild-type strain, ROCK were used in these investigations. Homozygous bronze females are sterile and stocks are maintained by crossing *bz*/+ females to *bz*/*bz* males. The strains