PRELIMINARY OBSERVATIONS ON THE RELATION OF LIGHT TRAP COLLECTIONS TO MECHANICAL SWEEP NET COLLECTIONS IN SAMPLING MOSQUITO POPULATIONS

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INTRODUCTION. Light traps have been used extensively to collect mosquitoes, but in many analyses of data thus obtained variations in attractivity of light to different species of mosquitoes have not been considered. The present study was undertaken to compare, both qualitatively and quantitatively, collections of mosquitoes from light traps and from a non-attractive device.

MATERIALS AND METHODS. Collections were made at weekly intervals from April 1954 through December 1955. Three New Jersey light traps equipped with 25-watt frosted incandescent bulbs were operated one night each week at 6-, 25-, and 40-foot elevations, respectively, on a tower in a wooded area (Fig. 1). On a different night each week, 6 pairs of mechanical sweep nets were operated from the tower at elevations of 3, 6, 15, 25, 40, and 50 feet. The sequence in which the traps and nets were used was alternated weekly. Data from 60 weeks when all series of traps operated successfully are considered in this report.

One of the mechanical sweep nets is shown in Fig. 2. The opening of the net, formed of a hoop of ¼-inch iron rod, was 18 inches in diameter. Attached to the hoop was an 18-mesh screen wire cone 24 inches long reinforced by ½-inch hardware cloth. The apex of the cone was truncated and a metal strip was attached

FIG. 1. Tower at Mossy Pond, Baker County, Georgia, used in study of vertical distribution of mosquitoes.

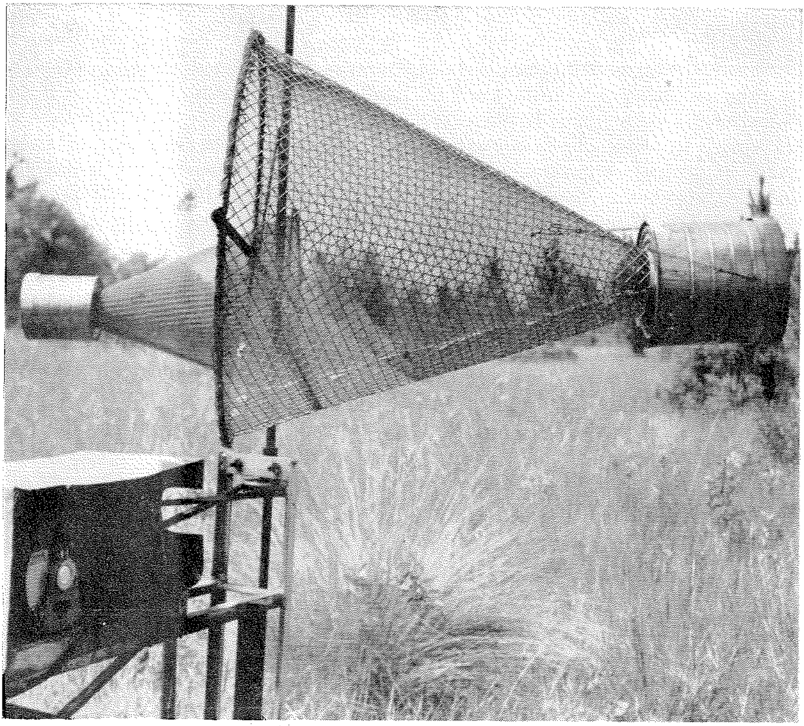

Fig. 2. Mechanical sweep net with cage attached.

to form a collar that would fit snugly inside the smaller opening of the holding cage. The cage for retaining and protecting mosquitoes was attached to the cone by two spring hooks. This cage consisted of two tin cans, one number 10 and one number 2 (Fig. 3). A hole, the diameter of the smaller can, was cut in the center of the bottom of the larger can. Both ends were removed from the smaller can and the rim of the cylinder was flared slightly to enable a snug fit when the small can was inserted in the opening of the large can. The small can was held in place by soldering the flared edge to the bottom of the large can. A screened top covered the opening of the large can. Since the height of the number 2 can is less than that of the number 10 can, mosquitoes could fly from the air stream to more protected parts of the cage. Nets with openings toward opposite directions were welded to the ends of a ½-inch iron rod 7 feet in length. Rods with nets attached were affixed to a ¾-inch iron rod 3 feet long held vertically on a stationary

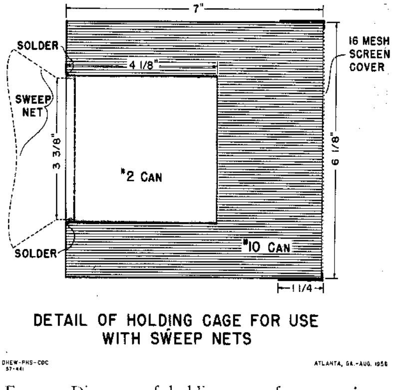

Fig. 3. Diagram of holding cage for mosquitoes caught by sweep nets.

support. The cones were rotated with axes parallel to the ground surface at approximately 25 r.p.m. Power was obtained by a belt and pulleys attached to a vertical ¾-inch iron rod 50 feet in length which was driven by a one horsepower electric motor at the 15-foot level. Sweep nets and light traps were controlled by automatic switches.

The light traps were operated from 6 p.m. to 6 a.m. To prevent escape of mosquitoes from the cages, sweep nets were operated from 6 p.m. until stopped manually around 9 a.m. the following morning. All specimens were identified except those in exceptionally large catches, in which case samples not less than one-eighth of the total catch were identified. Results of counts and identifications were recorded on field sheets and later transferred to mechanical record cards. Data on spatial distribution and activity patterns of various species of mosquitoes are to be reported elsewhere (Love and Platt, manuscript).

The index of attractiveness of light traps for any species was obtained by dividing the total number of specimens caught in the light traps by the total number taken in the mechanical sweep nets.

Results. Table 1 shows results of the study. In the upper portion of the table indices of attractiveness to light traps are listed in descending order for all species of mosquitoes where at least 100 specimens were collected by each method. *Uranotaenia sapphirina,* index 7.67; *Anopheles crucians,* index 6.21; and *Aedes vexans,* index 3.90, showed the greatest attraction to light traps. *Aedes infirmatus,*

TABLE 1.—Species and numbers of mosquitoes caught in mechanical sweep nets and light traps, and indices * of light trap attractiveness: Baker County, Georgia; April 1954–December 1955.

Species	Sweep Nets: Number of Specimens	Light Traps: Number of Specimens	Index
Uranotaenia sapphirina	1,488	11,417	7.67
Anopheles crucians	564	3,505	6.21
Aedes vexans	4,845	18,893	3.90
Culex (Melanoconion) spp.	295	753	2.55
Anopheles quadrimaculatus	282	703	2.40
Aedes atlanticus	113	259	2.29
Culex territans	125	161	1.29
Culex restuans	141	180	1.28
Aedes infirmatus	342	343	1.00
Psorophora ferox	529	128	0.24
Culiseta inornata	24	457	19.04
Aedes mitchellae	15	121	8.07
Anopheles punctipennis	5	34	6.80
Psorophora confinnis	27	171	6.33
Psorophora ciliata	7	30	4.29
Psorophora discolor	3	8	2.67
Mansonia perturbans	73	193	2.64
Culex quinquefasciatus	44	55	1.25
Culiseta melanura	34	42	1.24
Aedes fulvus pallens	13	14	1.08
Psorophora varipes	2	2	1.00
Culex nigripalpus	21	19	0.90
Orthopodomyia signifera	10	8	0.80
Aedes dupreei	77	52	0.68
Aedes thibaulti	8	4	0.50
Psorophora cyanescens	3	1	0.33
Aedes triseriatus	48	10	0.21

* The index of light trap attractiveness is statistically unreliable for the species of mosquitoes listed below the double line due to the small numbers collected by either or both methods.

index 1.00, had little attraction to light traps. The *Culex (Melanoconion)* spp. group, *Anopheles quadrimaculatus,* and *Aedes atlanticus* had about equal indices: 2.55, 2.49, and 2.29 respectively. *Culex territans* and *C. restuans,* indices 1.29 and 1.28 respectively, had little response to light traps. Some species in the same genus varied greatly in response to light traps. Three species of *Culex—territans, restuans,* and *quinquefasciatus*—responded similarly; all three showed a weak attraction to light traps.

The mosquitoes listed below the double line in Table 1 were collected in numbers believed too small to provide statistically valid indices. These indices may be changed when additional data become available. Indications are that *Culiseta inornata,* tentative index 19.04, probably will exhibit a very high index, perhaps the highest of all species studied. *Aedes mitchellae, Psorophora confinnis,* and *Anopheles punctipennis* are known to be strongly attracted to lights and will likely exhibit high indices.

DISCUSSION. The results reported here are based upon 60 weekly collections well distributed throughout the mosquito breeding seasons of 2 years when conditions of drought prevailed. The distribution and density of species are not regarded as characteristics of years when different climatic conditions prevail. Annual precipitation in 1954 was 27.13 inches (27.1 inches below average) and 39.64 inches in 1955 (14.5 inches below average). Consequently, species which breed in relatively permanent ponds were scarce. During spring and early summer of 1954 some of the comparatively permanent ponds were partially filled and most species that develop in such habitats were collected during this period. *Mansonia* spp. were collected at this time but not during 1955 after the complete drying of breeding areas late in 1954. The sweep nets have the advantage of sampling mosquitoes from an area of known extent. Since sweep nets probably are not attractive to mosquitoes and, consequently, catch only the specimens which happen to fly into the path of the nets in operation, specimens should be collecetd in numbers approximating their actual areal density at the time of collection. In contrast, light traps may positively attract phototactic species from a considerable area and negatively phototactic species may be collected in disproportionate numbers.

For example, indices for *Culiseta inornata* and *Psorophora ferox* were 19.04 and 0.24. The latter species is usually rare and the former relatively common in collections with light traps. With sweep nets, however, several times as many *P. ferox* as *C. inornata* were collected.

Comparison of relative density of species on the basis of collections from light traps may be misleading. For example, approximately 5 times as many *Anopheles crucians* as *A. quadrimaculatus* were collected in light traps. In sweep nets, however, the ratio of *A. crucians* to *A. quadrimaculatus* was only 2:1.

In spite of the limitations of light traps, they are probably the best single method for sampling the mosquito population of an area. In studies on ecology of disease, however, precise expression of vector density is essential for evaluation of transmission potential. Collections from light traps do reflect fluctuations in populations of some mosquitoes about as well as other methods (Love, Goodwin, and Smith, manuscript). Although various attempts have been made to determine the abundance of mosquitoes in an area, using the Lincoln index or similar methods, no practical means are available for estimating the actual abundance of mosquitoes.

The objective of the present study is to provide a method for applying data from light trap collections to indicate more accurately the actual species composition and comparative density of a local mosquito fauna. Other types of collecting devices might provide indices of different magnitude. Since all species would be similarly affected, however, the relationships between the index numbers would be the same.

SUMMARY. Procedures are described which enable interpretation of data from light trap collections to indicate more accurately the actual species composition and comparative density of mosquitoes. On different nights each week vertical series of light traps and mechanical sweep nets were operated in a wooded area near a mosquito breeding pond during 2 mosquito breeding seasons in southwestern Georgia. Indices of the attractiveness of light traps for 27 species of mosquitoes were determined by dividing the numbers of mosquitoes of each species taken in the light traps by the numbers taken in the sweep nets.

References

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