of a modification of the Greenberg feeding device which has been useful in feeding blood and other suspensions to mosquitoes. The improvements consist especially in the use of a membrane prepared from the crop of the chicken, and in the addition of a stirring mechanism to prevent sedimentation of suspended materials.

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EFFECTIVENESS OF CARBON DIOXIDE AS A MOSQUITO ATTRACTANT IN THE CDC MINIATURE LIGHT TRAP

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INTRODUCTION. Various models of light traps have been employed to determine adult mosquito population indices and to collect large numbers of specimens for disease transmission studies. Since phototropism is exhibited to varying degrees among mosquito species, a light source in a trap has not always proved to be the ideal attractant.

Carbon dioxide released from either compressed gas cylinders or dry ice has been used successfully as an attractant for collection of mosquitoes. Headlee (1934), Reeves (1951), and Reeves and Hammon (1942) conducted field studies showing that various mosquito species were attracted to carbon dioxide gas.

Results of tests [reported by Newhouse et al. (1966)] indicated that the total number and variety of mosquitoes collected with light traps baited with carbon dioxide was significantly greater than those traps unbaited.

Procurement and economics are of primary consideration when using carbon dioxide; therefore, it is essential to determine the minimum amount of carbon dioxide which will increase the mosquito collection rate.

MATERIALS AND METHODS. The study was conducted for 8 weeks at Edgewood Arsenal, Maryland, in a wooded area near the Post Pumping Station. Six CDC Miniature Light Traps were suspended from tree limbs in an area of approximately 3,200 square yards. Four of the light traps were equipped to release carbon dioxide from 50 pound compressed gas cylinders at the rate of 250 c.c., 500 c.c., 1000 c.c., and 2000 c.c. per minute respectively. The fifth light trap was operated with no light source and set to release 500 c.c. per minute. The sixth light trap (control) was operated with a standard light source but with no carbon dioxide. Light traps were operated 5 to 7 nights per week; however, all traps were not operated simultaneously due to un-

availability of additional traps (Figure 1). Plastic tubing, attached to each cylinder, was connected below the top cover and above the fan of each light trap. The rate of flow of carbon dioxide in each light trap was controlled by a Matheson pressure regulator, Model Number IL320, calibrated by a Standard Fischer flowmeter. The light traps and pressure valves were turned on between 6 p.m.–7 p.m. each test night and turned off the following morning between 8 a.m.–9 a.m.

It was not possible to maintain the flow at the precise level desired for 12 hours or longer because of the lack of sensitivity of the pressure gauges; therefore, each morning all pressure gauges were recalibrated and a reading was taken to compute the mean flow rate. Light traps were rotated weekly to compensate for any natural attractiveness or bias the traps may have had other than the carbon dioxide attractant. The trapped mosquitoes were returned to the laboratory for identification. Data obtained on trap nights that equipment failed to function properly were excluded.

RESULTS AND DISCUSSIONS. The table shows that all light traps releasing carbon dioxide attracted a greater number of adult mosquitoes than the control trap and, in general, they trapped more species of mosquitoes. Specific differences and number collected could not be compared since the light traps calibrated to release 250 c.c. and 2000 c.c. per minute were not run concurrently with the other light traps (Figure 1). The mean number of mosquitoes trapped per night from the light trap calibrated to release carbon dioxide at the rate of 250 c.c. per minute was approximately six-fold that of the

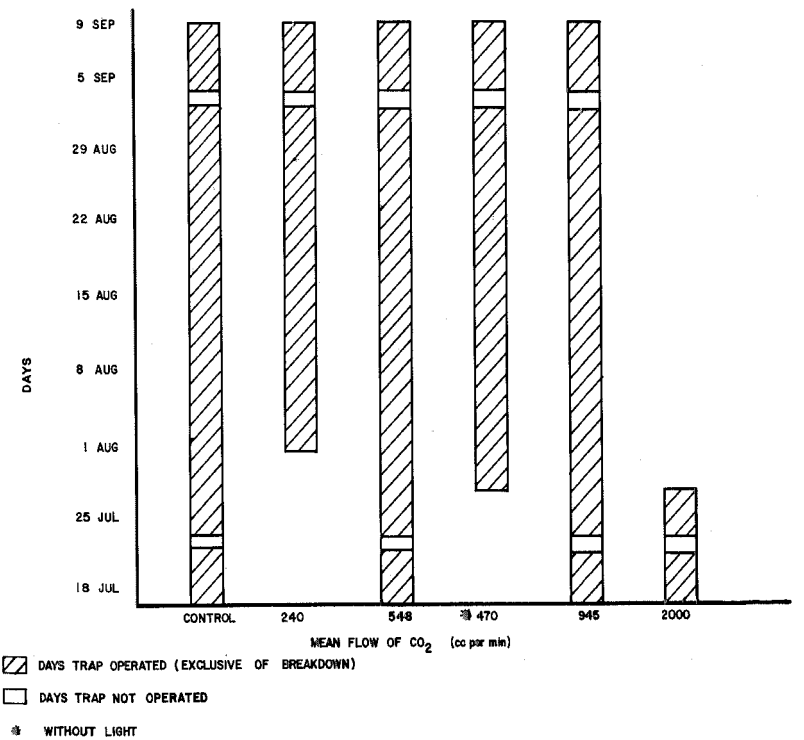

FIG. 1.—Periods of CDC light trap operation at selected CO_2 flow rates.

TABLE 1.—Total number of female mosquitoes collected at indicated mean flow rates of CO_2 per minute.

Species	Control[1]	240 cc[2]	*470 cc[3]	548 cc[4]	945 cc[5]	2000 cc[6]
Anopheles quadrimaculatus	9	24	11	43	87	18
Anopheles walkeri	8	13	3	60	89	88
Anopheles punctipennis	5	27	15	94	178	46
Anopheles crucians	0	0	0	1	5	5
Anopheles barberi	0	2	0	5	0	1
Aedes triseriatus	0	0	0	0	1	0
Aedes vexans	14	39	73	213	298	162
Aedes cantator	0	0	0	4	1	0
Aedes sollicitans	0	0	2	2	3	2
Aedes stimulans	0	0	0	0	0	2
Aedes mitchellae	0	0	0	1	1	1
Culex pipiens	9	50	112	103	106	154
Culex salinarius	154	652	1397	1617	2102	1273
Culex erraticus	6	3	2	4	5	0
Culex restuans	1	0	2	1	1	5
Psorophora ciliata	0	0	1	0	0	1
Psorophora confinnis	0	0	0	3	6	1
Psorophora discolor	0	0	0	0	0	4
Mansonia perturbans	0	7	3	5	3	11
Uranotaenia sapphirina	1	1	0	0	0	0
Total	207	818	1621	2156	2886	1774
Mean per trap	4.31	23.4	39.5	44.0	60.1	177.4

* Trap without light.
1—48 trap nights.
2—35 trap nights.
3—41 trap nights.
4—49 trap nights.
5—48 trap nights.
6—10 trap nights.

control. Flow rates below 250 c.c. per minute could not be field tested due to the insensitivity of pressure gauges. The light trap calibrated to release 500 c.c. of carbon dioxide with no light source trapped only mosquitoes, whereas all other traps contained a variety of insects, i.e., gnats, moths, and midges.

CONCLUSIONS. Carbon dioxide released at four rates with a standard light source and carbon dioxide released without a light source increased the total number of mosquitoes trapped with a CDC Miniature Light Trap. A greater variety of mosquito species trapped was also noted in those traps releasing carbon dioxide. The light trap without a light source releasing carbon dioxide showed considerable merit in that only mosquitoes were collected, simplifying separation and identification. Further evaluation with highly sensitive pressure gauges should be considered to determine the minimum amount of carbon dioxide which will attract adult mosquitoes.

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