

A COMPARISON OF CARBON DIOXIDE AND LIGHT AS ATTRACTANTS FOR CDC MOSQUITO TRAPS AT CLARK AIR BASE, PHILIPPINE ISLANDS¹

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ABSTRACT. Adult mosquitoes were collected on 31 nights during 1 August through 21 October 1976, at Clark Air Base, Republic of the Philippines. Six CDC miniature light traps were operated with either carbon dioxide (dry ice) bait or incandescent light as the attractant on alternate nights. Collections were made at fixed locations, 50 to 150 meters apart, along both

sides of a stream on Clark Air Base. A total of 10,099 female mosquitoes was collected; of these, 9,825 (97.3%) were captured using CO₂ while 274 (2.7%) were caught using incandescent light. Four species were taken only with the light traps while 22 species were collected solely in the traps baited with CO₂. Ten genera and 51 species were represented in the collections.

INTRODUCTION. Investigations have shown that differences occur in mosquito collections when two or more kinds of traps or attractants are used to sample the mosquito populations in the same area. The widest possible spectrum of species in the sampling is often the objective in trapping. Determination must be made as to whether a baited trap alone can attract all of the species that are normally drawn to an incandescent light trap, or if a combination of light and bait is required. Newhouse et al. (1966) in the southeastern United States, Herbert et al. (1972) in the Republic of Vietnam, and Magnarelli (1975) in the northeastern United States, used CO₂ (dry ice) as an attractant with CDC miniature light traps. They found that CO₂ significantly increased the numbers and/or species of female mosquitoes captured over those recorded for the incandescent light traps. A field investigation was conducted at Clark Air Base on Luzon Island, Republic of the Philippines, employing carbon dioxide and incandescent light on alternate nights as attractants with CDC traps. The objectives of the study were to evaluate the differences, if any, in the numbers and variety of species of female mosquitoes captured in traps using 2 different attractants, and to de-

termine if either CO₂ or light was species specific.

MATERIALS AND METHODS. Adult mosquitoes were collected using 6 CDC portable traps powered by 4 "D" cell flashlight batteries as described by Johnston et al. (1973). Traps were operated for 31 nights from 1 August through 21 October 1976 with either CO₂ (dry ice) or incandescent light as the attractant on alternate nights. Carbon dioxide was used on 14 nights and light was used during 17 nights. The study area measured 0.42 km by 1.25 km and consisted of a heavy swath of vegetation including members of the Leguminosae and Musaceae and numerous other types of trees, tall grasses, and brush bordering both sides of a narrow stream. A dirt road near the stream carried a small amount of vehicular, equine, and pedestrian traffic. Considerable water collected in the low areas around the study site during heavy rains. Temperatures on Clark Air Base ranged from 22° to 31°C with an average of 25°C during the periods the traps were operated.

The traps were placed at fixed locations on both sides of the stream and were spaced 50 to 150 meters apart. Three traps were hung on trees growing along the perimeter of a field on the west side of the stream. The other 3 traps were located on the east side in areas enclosed by trees and other vegetation. The traps were suspended 1.5 meters above ground level and

¹The views expressed herein are those of the authors and do not necessarily reflect the views of the United States Air Force or the Department of Defense.

all 6 traps were approximately 23 meters from the stream. On nights when CO₂ was used, approximately 2.2 kilograms of dry ice were placed in styrofoam containers and suspended near each trap. A plastic tube (15 millimeter inside diameter) extending from the container delivered CO₂ to the trap. Traps were operated from 1700 hours each day to 0600 hours the following morning. Trap specimen bags were detached and the mosquitoes were killed by placing the bags in a container with dry ice. Specimens were then packaged for identification.

RESULTS AND DISCUSSION. A total of 10,099 female mosquitoes representing 10 genera and 51 species was captured in the CDC traps (Table 1). Forty-seven species were collected using CO₂ and 29 species using light; of these, 22 species were captured only with the CO₂ bait and 4 species with light alone. Of the total number collected, 9,825 mosquitoes or 97.3% were captured using CO₂. Collections with incandescent light accounted for only 2.7% of the total number of specimens, but this portion included 57% of the species captured.

Based on the number of species captured, *Culex*, *Anopheles*, and *Aedes* were the predominant genera. *Culex* species, primarily *Cx. bitaeniorhynchus*, *Cx. tritaeniorhynchus*, and the *Cx. vishnui* subgroup, comprised 83.9% of all the mosquitoes collected. The genus *Aedes* accounted for 2.5% of the total specimens with *Ae. poicilius*, *Ae. vexans*, *Ae. flavipennis*, and *Ae. albopictus* being the most abundant species in the genus. The 13 species of *Anopheles* trapped represented only 0.9% of the mosquitoes collected. Three *Mansonia* species were collected, and they accounted for 9.6% of the total catch. *Ma. uniformis* was the most abundant species in the genus. Three specimens of *Topomyia*, a genus not heretofore collected at Clark Air Base, were captured in the light traps.

Actual or potential mosquito vectors of diseases in the Philippines were captured including *An. flavirostris*, the most important vector of malaria on Luzon Island (Hamon et al. 1970). A single specimen of this species was collected in a light trap. Ramos et al. (1976) also reported the capture of *An. flavirostris* at Clark Air Base with light as the attractant. Other disease

Table 1. Collection data for CDC traps operated at Clark Air Base, August–October 1976

Species	Collected with light	Collected with CO ₂	Total specimens collected	Light only	CO ₂ only	Collected with both attractants (Used separately)
<i>Aedeomyia catastica</i>	0	1	1		X	
<i>Aedes albopictus</i>	2	30	32			X
<i>Aedes andamanensis</i>	0	1	1		X	
<i>Aedes butleri</i>	0	1	1		X	
<i>Aedes flavipennis</i>	0	32	32		X	
<i>Aedes gardnerii</i>	0	11	11		X	
<i>Aedes lineatopennis</i>	2	11	13			X
<i>Aedes melanopterus</i>	1	0	1	X		
<i>Aedes nigilax</i>	0	1	1		X	
<i>Aedes pampangensis</i>	0	1	1		X	
<i>Aedes poicilius</i>	2	83	85			X
<i>Aedes scutellaris</i>	0	12	12		X	
<i>Aedes vexans</i>	2	60	62			X
<i>Anopheles filipinae</i>	0	1	1		X	
<i>Anopheles indefinitus</i>	0	15	15		X	
<i>Anopheles lesteri</i>	1	0	1	X		
<i>Anopheles ludlowae</i>	0	3	3		X	
<i>Anopheles maculatus</i>	0	1	1		X	
<i>Anopheles flavirostris</i>	1	0	1	X		
<i>Anopheles peditaeniatus</i>	0	1	1		X	

Table 1. (Continued)

Species	Collected with light	Collected with CO ₂	Total specimens collected	Light only	CO ₂ only	Collected with both attractants (Used separately)
<i>Anopheles philippinensis</i>	1	7	8			
<i>Anopheles pseudobarbistrois</i>	0	7	7			X
<i>Anopheles subpictus</i>	1	23	24		X	
<i>Anopheles tessellatus</i>	0	16	16			X
<i>Anopheles vagus</i>	1	4	5			
<i>Anopheles vagus limosus</i>	0	17	17			X
<i>Armigeres</i> spp.	1	3	4		X	
<i>Coquillettia crassipes</i>	6	106	112			X
<i>Coquillettia ochracea</i>	2	79	81			X
<i>Culex annulirostris</i>	1	53	54			X
<i>Culex annulus</i> (=vishnui)	7	599	606			X
<i>Culex bitaeniorhynchus</i>	101	2009	2110			X
<i>Culex fuscanus</i>	6	35	41			X
<i>Culex fuscocephalus</i>	10	50	60			X
<i>Culex gelidus</i>	3	75	78			X
<i>Culex incognitus</i>	0	661	661		X	
<i>Culex pipiens quinquefasciatus</i>	2	65	67		X	
<i>Culex pseudovishnui</i>	0	307	307		X	X
<i>Culex sitiens</i>	0	8	8		X	
<i>Culex tritaeniorhynchus</i>	34	2259	2293			
<i>Culex vagans</i>	0	75	75		X	X
<i>Culex vishnui</i> subgroup	20	2010	2030			
<i>Culex whitmorei</i>	1	91	92			X
<i>Ficalbia luzonensis</i>	34	23	57			X
<i>Mansonia annulata</i>	0	13	13		X	
<i>Mansonia annulifera</i>	0	1	1		X	
<i>Mansonia uniformis</i>	6	957	963			
<i>Uranotaenia arguellesi</i>	6	2	8			X
<i>Uranotaenia pylei</i>	5	2	7			X
<i>Uranotaenia testacea</i>	12	3	15			X
<i>Topomyia</i> spp.	3	0	3	X		X
Totals	274	9,825	10,099	4	22	25

Genera: 10

Species: 51

vectors were captured in both the CO₂-baited and the incandescent light traps with greater numbers being collected in the CO₂ traps. These mosquitoes with their associated diseases include: *Ae. albopictus*—dengue fever (Simmons et al. 1930); *Ae. poicilius*—Bancroftian filariasis (Cabrera and Tabangui 1951); *Cx. pipiens quinquefasciatus*—Bancroftian filariasis (Baisas 1958); *Cx. tritaeniorhynchus*—Japanese B encephalitis (Faust and Russell 1964); and *Ma. uniformis*—Bancroftian and Malayan filariasis (Edeson and Wilson 1964).

CONCLUSIONS. The carbon dioxide-baited CDC traps consistently attracted greater numbers of female mosquitoes and a wider variety and number of species than did the light traps when they were both used during a survey on Clark Air Base. The data show 4 species captured only with light and 22 species collected only with CO₂ while 25 species were attracted to both types of traps. The fact that some species were collected only with light suggests that optimal surveillance of female mosquitoes can be achieved by a program which utilizes both CO₂-baited

traps and incandescent light traps.

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