COMPARISON OF CDC MINIATURE LIGHT TRAPS AND HUMAN BITING COLLECTIONS FOR MOSQUITO CATCHES DURING MALARIA VECTOR SURVEYS IN PENINSULAR MALAYSIA[1]

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ABSTRACT. Four methods for collecting mosquitoes during malaria surveys were compared. They included: human biting collections, light traps with light only, CO_2 alone, and CO_2 plus light. The total number of mosquitoes collected per unit hour was greater with CDC light traps plus CO_2 than any other method. The light traps with light alone or CO_2 alone were less effective than a combination of the two and are not considered as valuable for collecting. If CO_2 was not available light alone could be used. However, previous collections indicate this is usually not very effective for most anopheline species. Human biting collections, though not as successful in total numbers, are considered necessary when collectors are available.

It is apparent from these and studies by other workers that new and improved methods are needed to evaluate malaria vector populations. Evaluations of new collection devices are being made by the authors with the hope of developing techniques that will make it possible to determine anopheline populations in situ and possibly predict future population fluctuations.

Malaria surveys in Malaysia in past years have relied primarily on human bait as an attractant for adult anopheline mosquitoes. The most common collection methods utilizing humans are bare leg collections and human bait traps. Both are effective methods of collecting anopheline mosquitoes. They do, however, require the physical presence of collectors during night-time hours and are subject to the usual biases associated with such collections.

A number of studies have been done since Sudia and Chamberlain introduced their battery operated light trap (CDC) in 1962. Newhouse *et al.* (1966) showed that light traps plus CO_2 (dry ice) collected more species and greater total numbers than those with light alone. In Thailand, Miller *et al.* (1969) compared light alone, CO_2 alone, and light plus CO_2, and found that the last significantly increased the mosquito catch. Herbert *et al.* (1972), working in the Republic of Vietnam with a similar evaluation of the CDC light trap came to approximately the same conclusions. In addition to their basic evaluations, both experiments showed that anophelines could be collected routinely with the CDC light trap if CO_2 were added. However, none of the anophelines collected during these surveys are considered vectors in the areas studied.

The present experiment had a two-fold objective: to determine if known malaria vectors could be routinely collected in CDC light traps and to compare light trap catches with human bait catches.

MATERIALS AND METHODS. The experiments were conducted in three villages near Kuala Brang, a rural area in Trengganu, which is an east coast state of Peninsular Malaysia. A malaria survey of the village children at this time revealed prevalence rates of between 30 and 47 per cent; about one-half of the infections were *Plasmodium falciparum,* one-third *P. vivax* and the remainder *P. malariae.*

The standard CDC miniature light trap was utilized for the tests. The regular collecting bag was replaced with a rigid cloth bag 12 inches long and 7 inches in diameter.

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The distal end of the bag was cloth screen so the mosquitoes inside could be seen. The fans and lights of the traps were powered by 6 volt DC flashlight batteries. Fresh batteries were used each night.

A total of nine light traps, three in each village, were set out nightly from 6:00 pm to 6:00 am. Each village had one light trap with CO_2 plus light, one CO_2 only and one light only. Four human collectors doing bare leg collections were set out in each village. They collected from 6:00 pm to 6:00 am. The collectors were placed out of sight of the light traps so they would not act as an attracting source for the traps.

The human biting collections were made by placing a small, glass vial over the mosquito as it landed on the collector's leg. The vial was quickly closed by inserting a wad of cotton in one end.

The following morning specimens were collected and taken to a field laboratory alive. Here they were killed with chloroform, counted and identified. The anophelines were further examined for malaria parasites.

The light traps were run for 8 nights and the human biting collections for 5 nights. The data are presented on a unit per hour basis, i.e., the average number of mosquitoes per light trap hour versus the average number collected per man hour.

RESULTS AND DISCUSSION. Table 1 presents the results of the collection data by species or genus. A total of 9458 mosquitoes were collected during the study. Of these, 1248, or 13 per cent, were anophelines. The human biting collections accounted for 0.5 anopheline and 3.5 culicines per man hour. The traps with light only collected 1.1 anophelines and 2.2 culicines per trap hour. With CO_2 only the catch was 0.3 anopheline and 4.5 culicines per trap hour. The trap with CO_2 plus light collected 1.8 anophelines and 13.1 culicines per trap hour.

Culex species were the most common mosquitoes collected. *Culex annulus,* a potential arbovirus vector, was the most frequently caught species.

Ten species of anophelines were collected during the survey. No known Malaysian vectors were caught during these studies. *An. aconitus,* an important vector in Java but not considered a vector in Malaysia was collected in small numbers. *An. kochi* was the predominant anopheline collected by all methods, and was more attracted to light plus CO_2 than human bait. This species, along with *An. aconitus,* are not considered vectors in Malaysia, however, they both have been listed by Sandosham (1969) as efficient transmitters of human malaria under experimental conditions. None of the collected anophelines were positive for malarial parasites.

Previous collections by the authors and by Ramachandran *et al.* (1970), in the same and nearby villages, yielded small numbers of *An. maculatus, An. balabacensis* and *An. letifer,* all considered malaria vectors in various parts of Peninsular Malaysia.

The results of the tests show that CDC light traps plus CO_2 was the most efficient method of collecting anophelines and culicines in the area studied. Human biting collections, normally considered the method of choice for collecting anopheline vectors in Malaysia was not as productive as light alone or light plus CO_2, however, considerable bias entered into these human biting collections. The collectors were local villagers and even though they had collected during previous surveys they were not as experienced or motivated as regular technicians. The collections do, however, represent the usual method of human biting collections used during routine malaria surveys and therefore should be considered a valid comparison to light traps. For specific information such as biting rates or biting times trained technicians would have to be used. The biting collections using local collectors are still considered a necessary technique for they provide information on vector preference that cannot be obtained from light traps. In addition, in remote villages such as the study area, considerable cooperation can be obtained from the local people if collectors are hired from the village surveyed.

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TABLE 1. Comparison of mosquito catches of various CDC miniature light trap combinations and human biting collections from three villages in Peninsular Malaysia.

	Human Biting Collections[a]	Light Only[b]	CO_2 Only[b]	Light plus[b] CO_2
Anopheles aconitus	10	1	2	7
Anopheles barbirostris	11	5	4	1
Anopheles crawfordi	26	14	2	2
Anopheles indiensis	33	20		59
Anopheles karwari	11	2		16
Anopheles kochi	187	246	82	335
Anopheles philippinensis	2			5
Anopheles separatus	11	2		5
Anopheles tessellatus	31	30	10	75
Anopheles vagus	2			2
Aedes albopictus	14	2	2	8
Aedes caecus	1			
Aedes chrysolineatus	1			
Aedes lineatopennis	88	7		19
Aedes poicelus	3			
Aedes vexans	66		2	9
Aedes sp.	5	1		1
Armigeres subalbatus	4	1	1	3
Coquillettidia nigrosignata	1		2	1
Culex annulus	809	462	830	3201
Culex bitaeniorhynchus	23	4	16	19
Culex fuscocephalus	16	10	4	25
Culex gelidus	117	23	50	106
Culex nigropunctatus		6	35	51
Culex sinensis	2			
Culex tritaeniorhynchus	733	27	272	148
Culex whitmorei	25		1	
Culex (Lopho) sp.	1	6	7	4
Mansonia annulata	1			
Mansonia dives	564	59	73	165
Mansonia uniformis	35			4
Uranotaenia sp.		22	1	11
Total anophelines	324	320	100	504
per unit hour	0.5	1.1	0.3	1.8
Total culicines	2509	630	1296	3775
per unit hour	3.5	2.2	4.5	13.1
Total mosquitoes	2833	950	1396	4279
per unit hour	4.0	3.3	4.8	14.9

[a] —Twelve collectors for 5 nights, 12 hours per night (720 man biting hours)
[b] —Three light traps for 8 nights, 12 hours per night (288 light trap hours)

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