THE USE OF CDC LIGHT TRAPS AND OTHER PROCEDURES FOR SAMPLING MALARIA VECTORS IN SOUTHERN IRAN

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ABSTRACT. An investigation was carried out over a year in the village of Chelow, Hormozgan Province, southern Iran, to study the efficacy of CDC light traps for sampling malaria vectors. The CDC light traps were useful in determining the seasonal and habitat distribution of *Anopheles stephensi* and *An. fluviatilis*, the primary and secondary vectors of malaria, in Chelow, as well as other mosquitoes in that area. Light traps compared favorably with other adult mosquito collection techniques for detecting the presence of vectors during periods of low density. In Iran, time and labor-saving features and flexibility for use in different situations make CDC light traps a useful sampling tool in the entomological assessment of malaria control programs.

INTRODUCTION

Malaria is still the most important health problem in Iran. Annual prevalence rates average 30 to 40 thousand and most cases occur in the south and southeastern part of the country. Operational surveys are conducted in Iran to furnish information on the effectiveness of malaria control programs. Mosquito collection techniques include pyrethrum space-spray catches in human and animal shelters, night biting collections on human and animal baits, pit shelter collections and larval collections.

The use of CDC light traps (Sudia and Chamberlain 1962) for sampling mosquito populations has been investigated by many workers and various modifications have been suggested to improve their efficiency as sampling tools. Special attention has been focused on the factors affecting efficiency of these traps (Service 1976, 1977). Odetoyinbo (1969) was the first to show that the CDC light trap could be successfully employed in sampling malaria vectors. There are reports (e.g., Bailly-Choumara 1973a, 1973b) indicating that CDC light traps catch more anopheline and culicine mosquitoes than do human bait collections and that they are useful for sampling outdoor mosquito populations in many areas.

In view of the scarcity of trained manpower, high cost of operation, and the need for testing sampling methods capable of alleviating or replacing the routine mosquito collection techniques used in malaria programs in southern Iran, it was considered important to investigate the efficiency of CDC light traps for the sampling of malaria vectors. This report evaluates the use of such traps in the village of Chelow, Hormozgan Province, where *Anopheles stephensi* Liston is the primary, and *An. fluviatilis* James the secondary vectors of malaria.

MATERIALS AND METHODS

STUDY AREA. The investigation was carried out over a period of 12 months at Chelow, Hormozgan Province (57°, 04′ E. longitude and 27° 09′ N. latitude), a small village of about 300 inhabitants, 69 buildings, 253 permanent and 36 temporary thatched shelters (local names: Kapar and Koumeh). This village lies about 11 km from the coast of Oman Sea and about 120 km from Bandar Abbas, a main port in the south. Salinity of soil in this area is high and cultivation is mainly restricted to palm trees. The average maximum and minimum temperatures in summer are 40° and 29°C and in winter 23° and 13°C, respectively. The relative humidity ranges from 36 to 79% and the average yearly rainfall is about 152 mm.

The water table is relatively high in this area and extensive marshes, springs and irrigation canals as well as animal hoofprints and cisterns serve as the breeding sites of *An. stephensi* and *An. fluviatilis*. Two other vectors of malaria, *An. superpictus* Grassi and *An. dthali* Patton are present in this area in relatively low numbers.

Anopheles stephensi is active throughout the year in this area with two peaks, one in April and May and the other, which is higher during August and September. This species is considered endophilic and endophagic, although it readily bites outdoors during the summer months when people and domestic animals rest and sleep in the open air. Maximum biting activity (89%) occurs before midnight (Manouchehri et al. 1976b).

Anopheles fluviatilis has a shorter period of activity throughout the year with two peaks, one in May and June and the other from September to the middle of December. This species feeds indoors and outdoors, resting both in houses and in outside shelters, in this area. Maximum biting activity of this species also occurs before midnight (Manouchehri et al. 1976a).

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COLLECTION TECHNIQUES

Pyrethrum space-spray catches. Spray catches were performed in six shelters (3 human and 3 animal shelters), located in different parts of the village (Fig. 1), by the standard method, using 0.2% pyrethrum spray. Attempts were made to insure that the sheets covered the floor space and all horizontal surfaces as accurately as possible.

Human and animal bait-catches. The biting collections on human and animal baits were conducted outdoors from 1800 to 2400 hr (during the period of maximum biting activity for *An. stephensi* and *An. fluviatilis*). Two local men were hired as baits and were stationed in two different parts of the village (Fig. 1). They were stretched with rolled up sleeves and exposed faces and feet. One experienced field

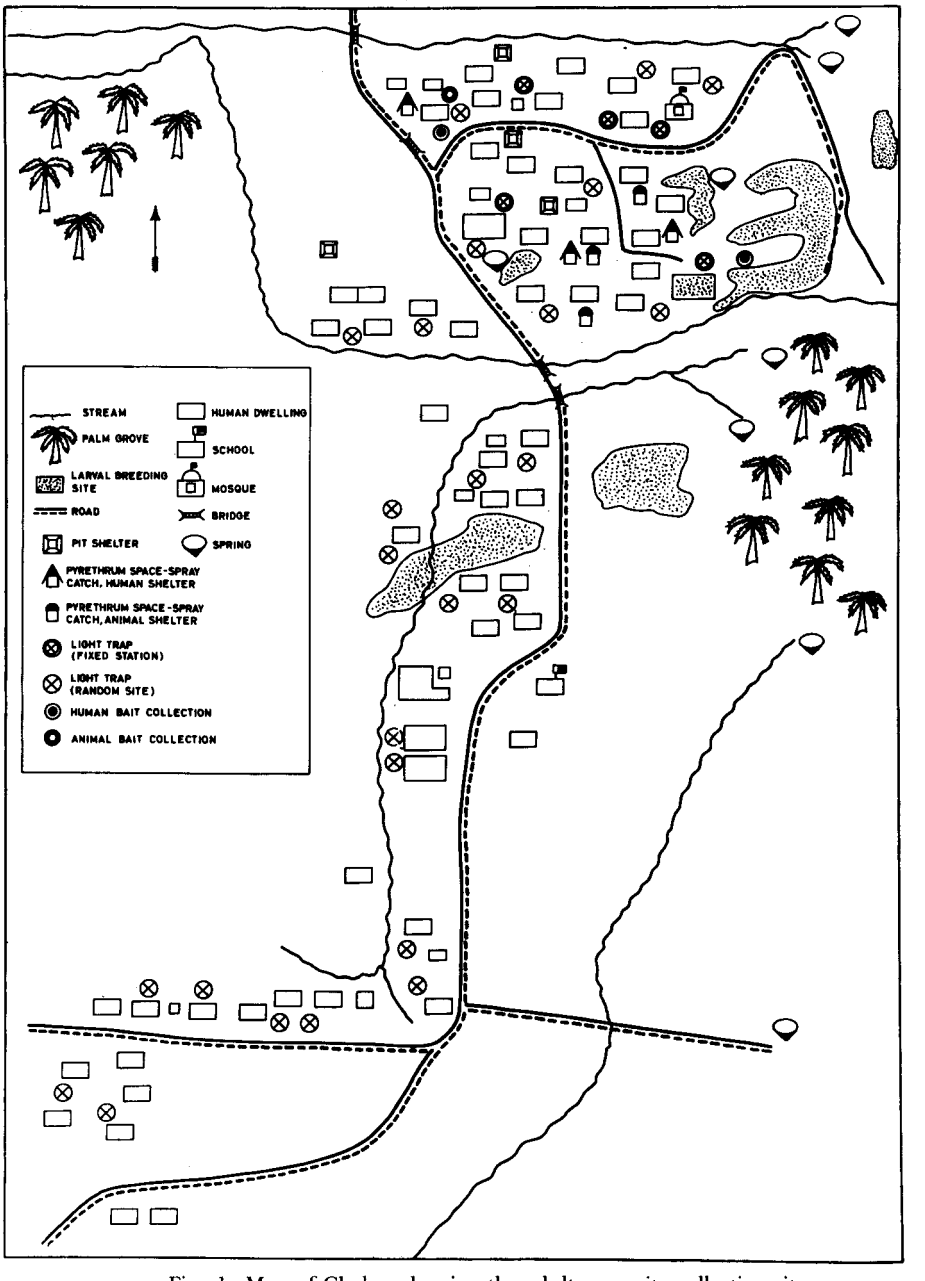

Fig. 1. Map of Chelow showing the adult mosquito collection sites.

Table 1. Summary of mosquito captures by different collections techniques at Chelow (Hormozgan, Iran) from April 1984 to April 1985.

Kind of mosquito	Light traps (7)		Pyrethrum spray catch: Pit Shelters (4)		Animal shelter (3)		Human shelter (3)		Human bait (2)		Animal bait (1)		Total catch
	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	
An. stephensi	714	31	108	44	771	104	4	0	152	0	88	0	2,016
An. fluviatilis	455	2	85	14	110	5	0	0	13	0	31	0	715
Other anophelines*	77	7	2	0	11	1	1	0	3	0	21	0	117
Culicines	1,337	104	530	433	61	74	9	5	43	0	43	0	2,639
Total	2,583	138	725	491	953	184	14	5	211	0	183	0	5,487

* *An. dthali, An. multicolor, An. pulcherimus, An. sergentii, An. superpictus, An. turkhudi.*

technician collected the biting mosquitoes at each station. Animal bait catches were made concurrently, by another field technician, collecting mosquitoes from a cow, tethered outside its shelter.

Pit shelter collections. Four pits, 120 × 90 and 150 cm deep, were dug under trees in different parts of the village (Fig. 1). About 45 cm from the bottom of the pit a small cavity, about 30 cm deep, was dug out horizontally from each of the four sides. Mosquitoes were collected, by aspirators, early in the morning, from these small cavities as well as the walls of the pits themselves.

CDC light trap collections. Seven CDC light traps were used in this program, five of which were operated in five fixed locations and the others were randomly operated in different sites, each time, as described below and shown in Fig. 1.

Two light traps were suspended from thatched ceilings in animal shelters (one fixed and one randomly selected site).

Two light traps were suspended from trees in the house yards (one fixed and one randomly selected site).

One light trap was suspended from a tree in the middle of the village (fixed station).

One light trap was suspended from the ceiling in a house occupied during the night of observation (fixed station).

One light trap was suspended from a tree near a mosquito breeding site (fixed station).

Traps were operated from sunset to sunrise (i.e., from 1800 to 600 hrs). Electricity for the traps was provided by 6-volt motorcycle batteries.

Twenty-six observations were made over one year (April 1984–85). Light trap collections as well as human and animal bait collections were performed on the same night. Pit shelter collections and pyrethrum spray catches were performed next day, early in the morning. Each mosquito caught was identified according to species, sex and abdominal conditions.

RESULTS AND DISCUSSION

A summary of mosquito collections by different collecting techniques in Chelow, from April 1984 to April 1985 (26 observations) is presented in Table 1. Of the 5,487 mosquitoes

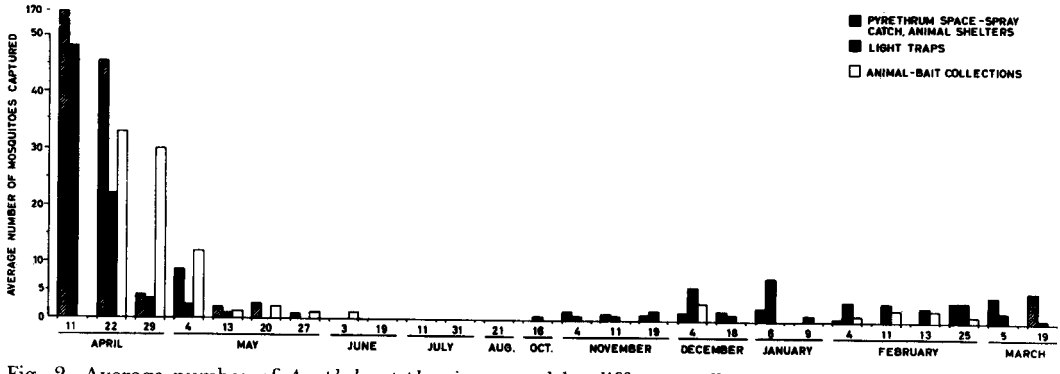

Fig. 2. Average number of *Anopheles stephensi* captured by different collection techniques in Chelow from April 1984 to April 1985.

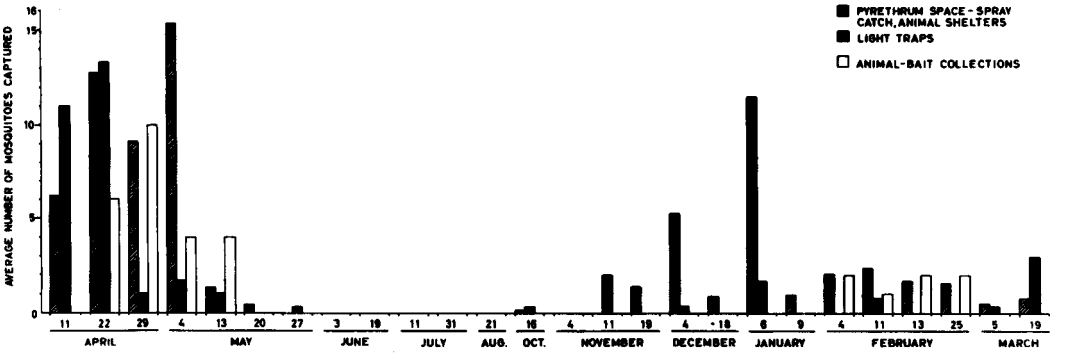

Fig. 3. Average number of *Anopheles fluviatilis* captured by different collection techniques in Chelow from April 1984 to April 1985.

collected in this study, 2848 were anophelines and the rest were culicines. Seventy-one percent of the anophelines were *An. stephensi*, and 25% were *An. fluviatilis*. The highest number of *An. stephensi* females were obtained from pyrethrum spray catches in animal shelters (42%) and in light traps (39%). The exophilic *An. fluviatilis* females were mostly collected in light traps (65.6%), where the highest number of culicines were also obtained (54.6%).

Light traps were also very useful in showing the seasonal distribution of *An. stephensi* and *An. fluviatilis* (Figs. 2 and 3). Both species showed two peaks; one in April and May and the other in December and January. The low incidence of the two species from early June to late October is due to the indoor spray programs performed with propoxur (2 g/m^2) on May 27 and 28,1984, and the high summer temperatures in the area.

A summary of light trap collections at 7 different locations at Chelow is presented in Table 2. Light traps suspended from thatched ceilings in animal shelters collected the highest number of mosquitoes (67.6%). The number of *An. stephensi* and *An. fluviatilis* females captured in these shelters were 67.6 and 84.4% of the total catch of 7 light traps, respectively.

Light traps were also the best tool for faunistic studies as they sampled all known anopheline species in the study area (Table 3). Pyrethrum spray catches of animal shelters and animal bait collections showed only 6 and 5 anopheline species, respectively. *Anopheles superpictus* and *An. sergentii* (Theobald) were only captured in light traps.

The proportion of blood-fed anophelines caught in this study was highest in pyrethrum spray catches (83%), followed by pit shelter collections (57.3%) and light traps (51.7%). However for the culicines, the highest proportion of blood-fed females were obtained in light trap collections (43%), followed by 37% for pyrethrum spray catches and 33% in pit shelter collections.

This study indicates that CDC light traps were useful for the study of seasonal and habitat distribution of *An. stephensi* and *An.*

Table 2. Summary of light trap mosquito captures at 7 locations at Chelow (Hormozgan, Iran) from April 1984 to April 1985.

Location of light traps	*An. stephensi* ♀	*An. stephensi* ♂	*An. fluviatilis* ♀	*An. fluviatilis* ♂	Other* anophelines ♀	Other* anophelines ♂	Culicines ♀	Culicines ♂	Total catch
1. Animal shelter (fixed location)	239	4	244	2	26	0	711	32	1,258
2. Animal shelter (random location)	244	3	140	0	26	0	153	15	581
3. House yard (fixed location)	54	6	16	0	12	0	137	16	241
4. House yard (random location)	20	3	10	0	1	0	59	5	98
5. Inside room (fixed location)	34	1	14	0	1	0	91	6	147
6. Middle of the village (fixed location)	81	10	9	0	7	1	123	17	248
7. Near breeding site (fixed location)	42	4	22	0	4	0	63	13	148
Total	714	31	455	2	77	1	1,337	104	2,721

* *An. dthali, An. multicolor, An. pulcherimus, An. sergentii, An. superpictus, An. turkhudi.*

Table 3. Summary of anopheline species captured by different collection techniques at Chelow (Hormozgan Province, Iran) from April 1984 to April 1985.

Method of collection	*An. dthali*	*An. fluviatilis*	*An. multicolor*	*An. pulcherimus*	*An. sergentii*	*An. stephensi*	*An. superpictus*	*An. turkhudi*
1. Light trap	*	*	*	*	*	*	*	*
2. Pyrethrum spray Catch-animal shelter	*	*	*	*	–	*	–	*
3. Pyrethrum spray Catch-human shelter	*	–	–	–	–	*	–	–
4. Animal bait catch	*	*	*	*	–	*	–	–
5. Human bait catch	–	*	–	*	–	*	–	–
6. Pit shelter	*	*	–	–	–	*	–	–

fluviatilis in Chelow, Hormozgan, Iran. These traps also provided a tool for overall sampling of the mosquito fauna in this area. It compared well with other adult collection techniques for detecting the presence of vectors (especially the exophilic species) during periods of low density. The time and labor-saving features and flexibility for use in different situations makes the CDC light trap a useful supplementary method for entomological assessment of malaria control programs in areas where *An. stephensi* and *An. fluviatilis* are important vectors.

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