TRIALS WITH PORTABLE SCREEN ROOMS MODIFIED FOR USE AS ANIMAL-BAITED NET TRAPS FOR MOSQUITO COLLECTION

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ABSTRACT. Trials in Larimer County, Colorado during July and August 1984, with recreational screen rooms modified as large animal-baited mosquito traps are described. The two units tested are free-standing, portable and require no external support. In all-night trials, 462.5 mosquitoes/trap night were captured with horse bait compared with 367/trap night with CDC light traps. In 2-hour evening comparisons, mosquitoes collected per trapping period totalled 416 for horse-bait traps, 132 for light traps, and 93 for human-bait traps. Animal-baited screen rooms offer an alternative to existing methods for mosquito surveillance.

INTRODUCTION

Adult mosquito populations have been sampled by a wide variety of methods (Service 1976). Mosquito surveys in conjunction with arbovirus ecology studies frequently involve the use of traps baited with dry ice or a suitable host animal. These methods have obvious limitations; dry ice is not always available in remote areas, and traditional animal enclosures are usually bulky, heavy or non-portable (Jones 1961, Service 1976, Bram 1978, McReadie et al. 1984).

Recently, Mitchell et al. (1985) utilized a horse-baited net trap in an arbovirus ecology study in Argentina. While portable, their trap was not self-supporting but had to be suspended by corner ropes from nearby trees or other tall objects.

The need for overhead support precludes use of this type in places where trees or other suitable supports are scarce or absent. Commercially available, portable screen rooms designed to provide insect-proof outdoor living facilities in campgrounds or backyards are self-supported from external, demountable, truss-type frames. They appear to be readily adaptable for use as animal-baited net traps and, because they are free-standing, would have few restrictions as to placement. Our modifications of two such screen rooms and results of preliminary trials in which they were used as horse- and human-baited traps are presented in this report.

MATERIALS AND METHODS

The two portable screen rooms selected for use were a 3.0 × 4.2 × 2.3 m "summer screen house" supplied by L. L. Bean,[1] Freeport, ME 04033 (Fig. 1A) and a smaller 3.6 × 3.6 × 2.2 m "screen house" marketed by Academy Broadway Corp.[1], Smithtown, NY 11787 (Fig. 1B). The former room which weighs approximately 15.8 kg is made of vinyl laminated to heavy Dacron® fabric with 18 mesh screen sides; the latter lighter duty unit is made of polyethylene plastic with 28 × 7 mesh sides. Its weight is approximately 14 kg. Both units are floorless supported by external, tubular frames, have an internal adjustable-height ridge pole and nylon-zippered entries.

To convert them to use as mosquito traps similar modifications were made to each of the screen rooms. Two 41 cm vertical slits reinforced with nylon tape edging were cut at the bottom of each corner of the room to permit all four sides to be raised above ground level (Fig. 1, C, D). This provided access for insects attracted to the bait inside the trap while permitting the corners to remain pegged to the ground. During this investigation, the larger trap was baited with a horse, estimated by its owner to weigh 340 kg (750 lb). When the animal was placed in the trap, the sides were rolled 25–30 cm above the ground and secured by spring clips. At the end of the trapping period, the clips were removed and the sides were lowered before the entry was unzipped and the animal was led from the trap. Mosquitoes were then collected from the walls of the trap by battery-powered aspirators. A human attractant was used in the smaller trap. The procedures were similar to those outlined above for the horse-baited trap except that a cot equipped with a mosquito net was provided for the occupant who remained within this protection throughout the trapping period. The two screen rooms were set up approximately 300 m (328 yards) apart in a horse pasture in Larimer

[1] Use of trade names or commercial sources is for identification only and does not constitute endorsement by the Public Health Service or by the U.S. Department of Health and Human Services.

County, Colorado. To provide comparative mosquito collection data, irregularly spaced sites for dry ice-supplemented Centers for Disease Control (CDC) light traps (Newhouse et al. 1966) were established in the line of large cottonwood and Russian olive trees separating the screen rooms. Two trapping schedules were used: an all-night period from approximately 1 hour before sunset to 1 hour after sunrise employed for horse-baited and simultaneous CDC light trap collections and a 2-hour period starting at the same time but ending 1 hour after sunset, in which simultaneous catches were made with horse and human attractants and with light traps. All collections were made between July 19 and August 31, 1984.

RESULTS

Six night-long trapping periods yielded 2,776 mosquitoes of at least 11 species from the horse-baited trap. The predominant species was *Aedes vexans* (Meigen), which represented 68.8% of the total number collected by this method. *Culex tarsalis* Coquillett and *Ae. dorsalis* (Meigen) were the next most abundant, each comprising just under 10% of the total. All remaining species combined contributed less than 12% (Table 1). During 3 of the 6 nights on which the horse-baited trap was operated, CDC light traps were run for 14 trap nights. These collections produced 4,711 mosquitoes representing at least 15 species. *Aedes vexans* again

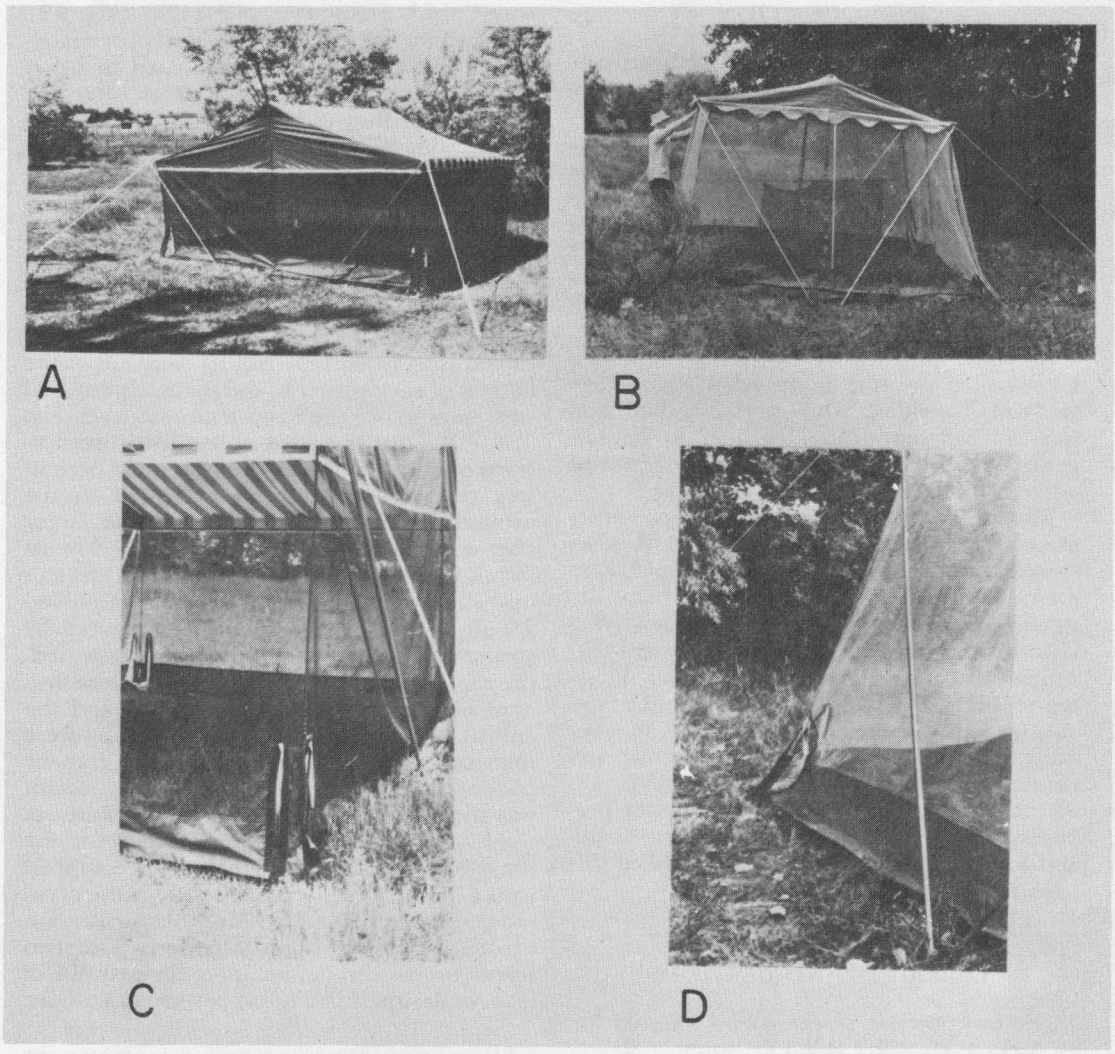

Fig. 1. A. Larger screen house used with horse bait; B. Smaller screen house used with human attractant; C. Detail of vertical corner slits in larger screen house; D. Detail of vertical corner slits in smaller screen house.

was by far the most abundant species (Table 2), but the number per trap night was only one-third that of the horse-baited collections. It made up approximately 70% of the horse-baited catch but only about half (51.9%) of the light trap captures. As in the horse-baited collections, *Cx. tarsalis* and *Ae. dorsalis* followed *Ae. vexans* in abundance; however, the numbers of *Cx. tarsalis* exceeded those attracted to the horse by a ratio of 81.6/65.0 per trap night, and they comprised 24% of the light trap total but only 8.6% of the horse-baited catch.

The lower portion of Table 2 summarizes the results of 5 trapping periods extending from an

Table 1. All-night mosquito collections from a horse-baited, screen room net trap, Larimer County, Colorado.

Species	Jul 19	Jul 20	Jul 25	Aug 9	Aug 16	Aug 31	Total	Mean no. per trap night	Mean percent of total
Aedes dorsalis	17	27	6	172	29	13	264	44.0	9.5
Ae. fitchii	1	1	—	—	—	—	2	0.3	<0.1
Ae. hendersoni	1	1	—	—	—	—	2	0.3	<0.1
Ae. melanimon	6	27	13	101	13	1	161	26.8	5.8
Ae. nigromaculis	1	1	—	1	—	—	3	0.5	0.1
Ae. sticticus	1	2	—	—	—	—	3	0.5	0.1
Ae. trivittatus	2	10	12	66	3	—	93	15.5	3.4
Ae. vexans	203	354	451	796	68	39	1911	318.5	68.8
Ae. spp.	—	3	4	16	1	—	24	4.0	0.9
Cx. pipiens	—	—	—	—	1	1	2	0.3	<0.1
Cx. tarsalis	39	51	18	126	17	24	275	45.8	9.9
Culiseta inornata	1	3	10	8	2	12	36	6.0	1.3
TOTALS	272	480	514	1286	134	90	2776	462.5	

Table 2. Overnight and 2-hour mosquito collections made with horses and human attractants in screen room net traps and with CDC light traps, Larimer County, Colorado.

		Mean no. per trap night			Mean percent of total		
		Attractant					
Trapping period and dates	Species	Horse	Light trap	Human	Horse	Light trap	Human
Overnight	*Aedes dorsalis*	68.3	29.4		9.0	8.6	
Jul 20, 25	*Ae. melanimon*	47.0	19.4		6.1	5.7	
Aug 9	*Ae. sticticus*	<1.0	3.1		<0.1	0.9	
	Ae. trivittatus	29.3	21.4		3.9	6.3	
	Ae. vexans	533.7	176.4		70.2	51.9	
	Culex pipiens	—	<1.0		—	0.1	
	Cx. salinarius	—	1.4		—	0.4	
	Cx. tarsalis	65.0	81.6		8.6	24.0	
	Culiseta inornata	7.0	2.2		0.9	0.6	
	All others[1]	9.0	4.8		1.2	1.4	
	TOTAL	760.0	340.1				
2 hours	*Aedes dorsalis*	33.0	7.0	14.6	7.9	5.3	15.7
SS−1–SS+1[2]	*Ae. melanimon*	18.0	3.7	3.8	4.3	2.8	4.1
Jul 27, 31	*Ae. nigromaculis*	—	<1.0	—	—	0.1	—
Aug 3, 8, 10	*Ae. sticticus*	0.6	<1.0	—	0.1	0.3	—
	Ae. trivittatus	17.6	21.0	5.6	4.2	15.9	6.0
	Ae. vexans	307.0	75.8	64.6	73.8	57.5	69.6
	Culex pipiens	—	<1.0	—	—	0.2	—
	Cx. salinarius	—	<1.0	—	—	0.2	—
	Cx. tarsalis	27.4	21.6	3.6	6.6	16.4	3.9
	Culiseta inornata	2.0	<1.0	—	0.5	—	—
	All others[3]	10.4	1.2	0.6	2.5	0.9	0.6
	TOTAL	416.0	131.3	92.8			

[1] *Aedes campestris, fitchii, hendersoni, intrudens, nigromaculis,* and unidentified *Aedes* spp.
[2] SS−1–SS+1 = sunset minus 1 hour to sunrise plus 1 hour.
[3] *Aedes idahoensis, intrudens, Culex restuans,* and unidentified *Aedes* spp.

hour before to an hour after sunset during which horse- and human-baited and CDC light traps were operated simultaneously. The horse-baited trap accounted for 2,080 mosquitoes of at least 8 species during these restricted trapping periods. Light trap and human-bait totals were 2,632 and 464, respectively. The light traps captured at least 12 species, whereas only 5 were taken from the human bait trap. Largely because of its greater attraction for *Ae. vexans,* the predominant species, the horse-baited catch total was only 21% less than the combined catch of the 4 light traps, though the light traps captured more species. Human attractants proved the least effective trapping method in terms both of numbers of mosquitoes and numbers of species.

DISCUSSION

The screen rooms functioned well as net traps. They were easy to transport and erect and, when properly guyed, proved stable in gusty winds. Although a relatively even ground surface is required, the adjustable nature of their support allows these units to be sited on gently sloping terrain. Unlike the numerous other large animal-baited traps that have been described, they have the advantage of availability as ready-made units requiring only slight modification. The slits that allowed the sides of the screen rooms to be raised and lowered permitted a few mosquitoes, agitated by the movements of the collectors, to escape. This problem was more pronounced with the unit shown in Fig. 1D since its sloping sides tended to result in wider gaps than did the vertical sides of the other screen room (Fig. 1C). We feel that adding nylon zippers or Velcro® closures to these corner slits would be a worthwhile modification. The size of the mesh enabled the capture of tabanids and simuliids as well as culicids, but nothing smaller.

The reasons for the small catches with human attractants (Table 2) are not fully explained by the obvious differences in size and CO_2 production between the horse and human baits or the enclosure of the humans in a protective bed net, though these factors doubtless played a part. On one occasion, a yard light interfered with the test, and only 4 mosquitoes were collected. However, 3 nights later a similar test yielded only 7 specimens in the absence of any recognized interference. These trials that involved 2 individuals contrasted markedly with results obtained with a third person who averaged 220 mosquitoes in 2 trials. Results with the parallel horse-baited collections were much more consistent. The same animal was used in all trials, which eliminated differences in host attractiveness as a source of variation.

The CDC light trap, supplemented with dry ice, has become widely accepted as a means of collecting large numbers of mosquitoes for arbovirus survey purposes (Sudia and Chamberlain 1967). An animal-baited, free-standing net trap provides a logical alternative that is particularly appropriate to studies concerned with the equine encephalitides. In addition, net traps offer a convenient substitute for the more cumbersome Magoon or other types of heavy stable traps that have frequently been used with bovine baits in malaria vector studies or with various animals in host preference studies. We believe that commercially available screen rooms are adaptable to many of these purposes.

ACKNOWLEDGMENT

The authors thank Carl J. Mitchell for the suggestion that led to our tests of portable screen rooms as mosquito traps, and Mr. and Mrs. Rex Story for permission to use their pasture and horse.

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