effective protection with a topical repellent at the same time mosquitoes were readily biting subjects carrying electronic devices. Finally subjects carrying the devices were readily bitten by *Ae. sollicitans*. There is therefore no evidence that these devices have any effect on the biting behavior and annoyance caused by the 2 species in these tests.

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OBSERVATIONS ON THE TIME OF ATTRACTION OF SOME PAKISTAN MOSQUITOES TO LIGHT TRAPS

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Concomitant with a series of all-night biting collections at the Ghulam Mohammad cattle shed near the village of Sattoki, Kasur District, Punjab Province, Pakistan (Reisen and Aslamkhan 1977), New Jersey and C.D.C. light traps were operated throughout the night at monthly intervals during 1976. With the exception of the studies of Aslamkhan and Salman (1969) and Reisen et al. (1976a, b), reports on light trap operation have not been published from Pakistan.

A N.J. light trap was suspended from a tree about 2-m from the ground and 25-m to the east of the cattle shed, and 2 C.D.C. light traps suspended from the eaves on the east and west end of the cattle shed. Traps were operated from dusk to dawn at monthly intervals with collection containers changed at 2-hr intervals. As few specimens were collected during each interval, collections were pooled over the entire year to ascertain the time of attraction of the mosquitoes to light traps.

A total of 522 female and 82 male mosquitoes comprising 14 species in 5 genera were taken during the 28 trap nights in 1976 (Table 1). *Cx. tritaeniorhynchus* was most prevalent among female specimens comprising 56.8% of the total followed by *An. culicifacies* (14.4%) and *An. annularis* (8.1%) (Table 1). Conversely, *An. culicifacies* was most prevalent among male specimens collected (51.2%) followed by *Cx. tritaeniorhynchus* (17.1%), *Aedes caspius* (9.8%) and *An. stephensi* (9.8%) (Table 1). Mosquitoes were attracted to light traps throughout the year, although during the colder months only 4 species were collected.

Over 82% of the females and over 78% of the males were collected during the first half of the night with most of these (44.7% and 42.7%, respectively) coming to lights between dusk and 2000 hrs (Table 1). These times coincided with most mosquito biting (Reisen and Aslamkhan 1977) and swarming (Reisen1976, Reisen et al. 1977) and (Aslamkhan, 1976) rhythms at Sattoki. The C.D.C. traps collected more females, while the N.J. trap collected more males. This was attributed to trap juxtaposition in relation to available hosts and breeding sites. The N.J. trap was situated closer to the agricultural field resting sites of the exophilic species (e.g. *Cx. pseudovishnui, Cx. tritaeniorhynchus, Ae. caspius*) and was adjacent to a stagnant pool which produced *Cx. tritaeniorhynchus* and several anopheline species during part of the year, while the C.D.C. traps were hung over bovid feed troughs and were thus near the primary blood meal source and the resting sites of the endophilic species (e.g. *An. annularis, An. culicifacies,* and *An. stephensi*). In agreement, a majority of the females collected in the C.D.C. traps were freshly fed, while with the exception of *Cx. tritaeniorhynchus,* most specimens collected in the N.J. trap were unfed or gravid. Another possible factor could be the degree of illumination provided by the two types of traps, although this aspect requires further investigation.

Light trap operation seems to be an adequate method for sampling Pakistan mosquitoes, although it is far less productive than buffalo biting collections which yielded 18,873 female mosquitoes comprising 18 species during the same time period (Reisen and Aslamkhan

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Table 1. Total numbers of mosquitoes (♀–♂) collected throughout the night in 3 light traps operated at monthly intervals during 1976.

Species	Months of collection	Time of night (Hrs.)						CDC[a]			Percent of total
		Dusk–0	20–22	22–24	24–02	02–04	04–dawn	NJ[b]	E	W	
Ae. caspius (Pallas)	Apr–Jun	9–7	2–1	0–0	0–0	2–0	0–0	12–8	1–0	0–0	3–10
An. annularis Van der Wulp	Feb–May, Aug–Oct	21–0	9–0	6–0	3–0	2–0	1–0	6–0	22–0	14–0	8–0
An. culicifacies Giles	Feb–Dec	33–18	13–4	19–12	1–1	5–3	4–4	7–5	47–18	21–19	14–51
An.nigerrimus Giles	Apr–Sep	6–0	4–1	1–1	1–1	6–1	3–0	3–4	12–0	6–0	4–5
An. pulcherrimus Theobald	Feb, Aug–Oct	3–0	1–0	1–0	2–0	1–0	1–0	0–0	5–0	4–0	2–0
An. stephensi Liston	Feb–Mar, May–Jun, Oct–Dec	10–4	2–3	2–0	1–0	0–1	1–0	4–6	8–1	4–1	3–10
Cx. bitaeniorhynchus Giles	May–Aug	2–1	3–0	1–0	0–0	1–0	0–0	2–1	3–0	2–0	1–1
Cx. fuscocephalus Theobald	Feb	0–0	0–0	0–1	0–0	0–0	0–0	0–0	0–1	0–0	0–1
Cx. pipiens fatigans Wiedemann	Jan–Mar, May	5–0	1–0	1–1	1–0	0–0	0–0	1–0	4–1	3–0	2–1
Cx. pseudovishnui Colless	Feb–Sep	12–1	3–0	2–0	4–0	0–1	0–0	16–2	4–0	1–0	4–2
Cx. tritaeniorhynchus Giles	Apr–Dec	129–3	57–4	59–1	37–5	8–1	6–0	77–10	107–1	112–3	57–17
Cx. vagans Wiedemann	Mar	1–0	0–0	1–0	0–0	1–0	0–0	0–0	2–0	1–0	1–0
Fi. chamberlaini clavipalpus (Theobald)	Jul	1–1	0–0	0–0	0–0	0–0	0–0	1–1	0–0	0–0	0–1
Ma. uniformis (Theobald)	Apr, Jul, Aug	1–0	1–0	8–0	0–0	0–0	0–0	2–0	1–0	7–0	1–0
Total:	522–82	233–35	96–13	101–16	50–7	26–7	16–4	131–37	216–22	175–33	
Percent:		45–43	18–16	19–20	10–9	5–9	3–5	25–45	41–27	34–28	

[a] 9 trap nights.
[b] 10 trap nights.

1977). Light traps have the advantage of collecting both male and female mosquitoes as well as those phototactic species such as *Ficalbia chamberlaini clavipalpus* which are not attracted to bovid bait.

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THE USE OF INSOLUBLE FOAM IN MOSQUITO CONTROL

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The ineffectiveness of larvicidal oils and chemical insecticides in controlling *Culex quinquefasciatus* Say (= *fatigans* Wiedemann) and other polluted water breeders (Graham & Gratz 1975) has stimulated the devising of a noval technique to overcome this important problem.

Our procedure consists in the application of a 'blanket' of carbon dioxide, entrained as a foam by a water-insoluble surfactant stabilizer. The foam is produced by using a soda-water type apparatus or, on a larger scale, a carbon dioxide type fire extinguisher. The foaming solution is a fine dispersion of kerosene solution of surfactant (30%w/v) in water (1:600) generated at an expansion of approximately 2, so that one liter of foam, sufficient to cover 1 m^2 of surface, is produced from 1 gm stabilizer. Such a foam, about 1 cm thick, gradually breaks down to a single-bubble layer after about 2–3 days, during which it is 100% lethal to mosquito juveniles. After this period bubble-free patches appear but, for unknown reasons, even this 'patchwork' surface remains lethal for some time afterwards. It remains deterrent to the mosquito for long periods subsequently. These periods can be extended roughly in proportion to the concentration or thickness of the foam applied. Thus at 3g/sq.m. control is 100% over 12 days or so (determined by the addition of fresh larvae and pupae at intervals).

The foam is environmentally innocuous since the kerosene solvent evaporates reasonably quickly at 27°C, leaving a biodegradable surfactant which is, in itself, non-toxic and non-injurious to the environment. It is sufficiently tenacious to resist the effect of light winds and rain (it will in fact survive quite heavy rainfall since the stabilizer is water-insoluble) and would appear to be the most effective way of covering polluted surfaces, short of adding excessive quantities of bulk oil which gives rise to severe problems of oil pollution.

Field trials are planned in Africa during 1977 and laboratory tests are proceeding on various formulations, including the effect of the solvent. This study is part of a programme of research on monolayer control of mosquito financed by the Medical Research Council. (McMullen 1972).

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