After confirming that larvae were present, the trap was lowered into an open pit-latrine or ditch on a plastic thread tied to the wire-handle until the plastic base reached the water surface (Fig. 3). The plastic thread was attached to the wall of the pit-latrine in order to prevent movement of the trap. Pupae gather directly beneath the trap as it provides the necessary shade. This was demonstrated by laboratory experiments conducted indoors and outdoors (unpublished data). When the adults emerge, they escape through the lower lampshade and conical plastic trap into the cage (Figs. 1 and 2), and once they enter they cannot escape. After one or two days the cage was lifted out and a cotton plug was inserted at the opening of the conical plastic trap of the lower lampshade to prevent any escape of mosquitoes. The trapping capacity of this cage depends upon the availability of pupae in that particular pit-latrine or ditch. The entire trap can be placed in a freezer to kill the mosquitoes or they can be anaesthetized with Co_2 introduced by rubber tubing on top of the upper lampshade as already described. This trap is used in areas where open pit-latrines (lacking lids) or ditches are situated close to the human dwellings.

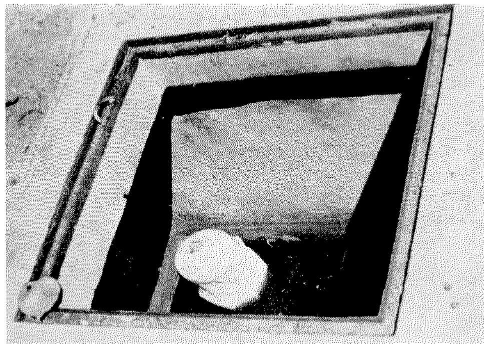

Fig. 3. Trap in use inside the pit-latrine of S. V. University campus, Tirupati, India.

The present cage has been used several times on our University Campus for trapping mosquitoes; all were *Culex quinquefasciatus* Say which is the only species breeding in pit-latrines (Table 1).

The first author gratefully acknowledges the Indian Council of Medical Research, New Delhi, India, for their fellowship (Grant no. 70/166/80 ECD–II). Thanks are given to the Head of the Department of Zoology, S. V. University, for providing necessary facilities.

Table 1. Adult *Culex quinquefasciatus* collected with the emergence trap from pit-latrines on the S. V. University campus, Tirupati, India.

Date (1984	Duration (hr)	No. of mosquitoes trapped
March 6	24	26
March 8	36	120
March 9	18	31
March 10	28	87
March 12	36	169
March 14	48	240

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SUSCEPTIBILITY OF *ANOPHELES QUADRIMACULATUS* AND OTHER MOSQUITOES TO *BRUGIA PATEI* (NEMATODA: FILARIOIDEA)[1]

JAI K. NAYAR[2], JEROME C. DJAM[3] AND JUDY W. KNIGHT[2]

Brugia patei was described by Buckley et al. (1958) from the lymphatic systems of dogs, cats and Genet cats on Pate Island off the coast of Kenya. It was brought to England by these authors in the mosquito vectors, *Mansonia africana* (Theobald) and *Mansonia uniformis* (Theobald), and there it was maintained in cats. Subsequently, Laurence and Pester (1961a, 1961b) showed that laboratory colonies of *Ma. uniformis* and *Anopheles gambiae* Giles, both common mammal-biting mosquitoes in Africa, could be successfully infected with *B. patei*, and later, Laurence and Pester (1967) adapted *B. patei* to *Aedes togoi* (Theobald), a species present in China, Korea, Siberia and Japan. Oothuman et al. (1974), however, described its abnormal development in *Anopheles atroparvus* Van Thiel, a western European species. In early 1970, *B.*

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patei was brought to California, USA, in a cat, and a Liverpool selected black-eyed strain of *Aedes aegypti* (L.) was found to be susceptible; this mosquito was used to transmit *B. patei* to the laboratory rodent, *Meriones unguiculatus* by Ash (1973). Recently, *B. patei* was brought to Florida, USA, and this afforded us an opportunity to test mosquitoes for their susceptibility to this species of *Brugia*.

Three-to-five-day-old females of 7 species involving 10 strains of mosquitoes were tested for vector potential. Colonized females of *Anopheles quadrimaculatus* Say, *Anopheles albimanus* Wied., 3 strains of *Ae. aegypti* (Liverpool selected black-eyed (LVP) strain used here as a control, Vero Beach strains previously selected for susceptibility (VBS) and resistance (VBR) to *Dirofilaria immitis* (Sauerman and Nayar 1984), *Aedes taeniorhynchus* (Wied.), *Culex nigripalpus* Theobald, 2 strains of *Culex salinarius* Coq. (Vero Beach, FL, and Lake Charles, LA) and *Culex quinquefasciatus* Say were reared and maintained as described by Nayar and Sauerman (1975). *Anopheles albimanus* and *Cx. salinarius* (Lake Charles) were reared at the Insect Affecting Man and Animal Research Laboratory, Gainesville, Florida, and unfed adults were brought to the Florida Medical Entomology Laboratory (FMEL), Vero Beach, where they were maintained under standard conditions in a light-dark cycle of 12 hr at 27°C, with a relative humidity of 70 to 80%. The mosquitoes were fed a 10% sucrose solution prior to and after the infective blood meal.

Two jirds, one with a low microfilaremia (30 mff/20 μl of blood from orbital sinus puncture) and the other with a high microfilaremia (450 mff/20 μl of blood from orbital sinus puncture) were obtained from Dr. A. L. Vincent, University of South Florida, Tampa. These jirds were maintained at the FMEL and used for exposing mosquitoes. Mosquitoes of each species tested were blood-fed to repletion on both jirds after the jirds were anaesthetized with "Nembutal." Three lots of 50 females of each species were allowed only one infective blood meal on each jird; thereafter, the blood-fed females were maintained under the standard conditions described above. One lot of each species was maintained for recording daily mortality up to 12 days postinfectious blood meal. Mosquitoes from the second and third lots were used to monitor development of ingested microfilariae in the thorax. Quantitative and qualitative development of the microfilariae in these females were monitored by preparing wet mounts of the thorax of at least 25 females of each lot on the sixth day for number of developing L_1/L_2 stage larvae or moribund microfilariae here designated as prelarvae in the thorax. The number of L_3 larvae were checked in preparations of thorax and head made on the twelfth day.

Of the 7 species of mosquitoes tested, development of ingested microfilariae was found to take place in 2 species, *Ae. aegypti* (involving 2 strains LVP and VBS) and *An. quadrimaculatus* (Table 1). When microfilariae were ingested from the jird with lower microfilaremia, normal development of microfilariae was observed with no apparent deleterious effects on the survival of mosquitoes, as most of the adults survived 12 days postinfection (Table 1). When microfilariae were ingested from the jird with higher microfilaremia, the survival of mosquitoes was reduced by only 8 to 10% in *Ae. aegypti* during the first 6 days of development. However as the ingested microfilariae devel-

Table 1. *Brugia patei* infections and longevity in susceptible mosquitoes.

	Mean no. ± S.E. of developing larval/ ♀ on days				Mean % survival of fed ♀ on days			
	6		12		6		12	
	Jird I*	Jird**	Jird I	Jird II	Jird I	Jird II	Jird I	Jird II
Aedes aegypti-VBS strain	4.1 ± 0.9	40.7 ± 4.3	3.1 ± 0.5	40.1 ± 3.1	100	90***	98	30
Aedes aegypti-LVP strain	4.3 ± 0.8	28.2 ± 2.7	2.9 ± 0.5	21.8 ± 3.2	98	92***	66***	
Anopheles quadrimaculatus-Gainesville colony	2.1 ± 0.5	10.2 ± 1.0	2.2 ± 0.5	10.9 ± 2.0	100	100	92	82

* Jird I had 30 mff/20 μl of blood from orbital sinus puncture.
** Jird II had ca. 450 mff/20 μl of blood from orbital sinus puncture.
*** $P < 0.005$ between 6 and 12 days postinfection.

oped to the L_3 stage and started to move out of thoracic muscles, 34 to 60% mortality was observed in *Ae. aegypti* and 18% in *An. quadrimaculatus* by 12 days postinfection (Table 1).

In the remaining species of mosquitoes studied, only prelarvae were found. No developing larvae were observed in females of these species and none of the mosquitoes died during the 12 days postinfection. Usually 1 or 2 developing larvae in one out of 10 females were observed in *An. albimanus* and both strains of *Cx. salinarius*.

Two important aspects were apparent from these studies. First, these studies showed that the microfilariae of *B. patei* developed comparably in *Ae. aegypti* LVP and VBS strains. *Aedes aegypti* LVP strain supported development of *B. pahangi, B. malayi* and *D. immitis* (Macdonald and Ramachandran 1965). *Aedes aegypti* VBS strain also supports development of *B. pahangi* and *B. malayi* (Nayar, unpublished data). Additionally, the microfilariae of *B. patei* did not develop, but remained as prelarvae in the *Aedes aegypti* VBR strain. Secondly, *An. quadrimaculatus* in addition can successfully support development and transmit several other parasites, such as *Dirofilaria immitis, D. uniformis, D. tenuis, Brugia pahangi, Plasmodium falciparum, P. vivax, P. gallinaceum* and *P. berghei* (cf. Nayar and Sauerman 1975).

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EFFECT OF LOW TEMPERATURE ON THE MOSQUITO LARVICIDE AND PUPICIDE AROSURF®MSF (MONOMOLECULAR SURFACE FILM) AND ADOL®85 (INDICATOR OIL): PHYSICAL EVALUATIONS[1, 2, 3]

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Arosurf®MSF (Monomolecular Surface Film) is the designation for the two mole ethoxylate of isostearyl alcohol. The efficacy of this product for use in the control of natural populations of mosquito larvae and pupae as well as the effective use of the oleyl alcohol indicator oil Adol®85 to monitor field persistence of Arosurf MSF have been reported by Levy et al. (1980a, 1980b, 1981, 1982a, 1982b, 1982); however, most of their field trials were conducted against mosquitoes breeding in warm water (i.e. temperatures of ca. 14–35°C). Since spontaneous spreading/respreading of Arosurf MSF on the water surface is essential for the maintenance of a stable monomolecular film for effective mosquito control, and has been demonstrated in laboratory bioassays and field trials in warm water habitats of Florida, bioassays were conducted to determine if this product would spread satisfactorily on water at temperatures typically encountered in northern areas where snow pool mosquitoes are severe pests. Similar evaluations were conducted to determine if accurate Adol 85 indicator oil readings (Levy et al. 1980b) would result when used in conjunction

[1] Arosurf®MSF (= ISA-20E = Arosurf®66–E2); Adol®85 (= Adol®).

[2] Arosurf®MSF and Adol®85 are products of Sherex Chemical Company, Inc., P. O. Box 646, Dublin, OH 43017.

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