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EVALUATION OF VARIOUS INSECTICIDES AS RESIDUAL SPRAYS IN BUILDINGS NATURALLY INFESTED WITH *ANOPHELES QUADRIMACULATUS*

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Since 1957, a continuing evaluation of chemicals as residual sprays against *Anopheles quadrimaculatus* Say has been conducted at the USDA, Insects Affecting Man Investigations Laboratory at Gainesville, Florida (LaBrecque *et al.* 1958, Gahan *et al.* 1967, Wilson *et al.* 1970). The laboratory phase of the evaluation involves, basically, the exposure of adult female mosquitoes to residual insecticides, (1 gram per square meter or 100 milligrams per square foot) for one hour and recording the mortality produced one day later. Then mosquitoes are exposed to the residues once a month over a period of 6 months. The effectiveness of the insecticide is measured by the number of weeks that the residues produce 70 percent or better kill. Whenever possible, promising compounds (effective kill for 24 weeks) are later evaluated in the vicinity of Stuttgart, Arkansas, in wooden buildings that are naturally infested with *Anopheles quadrimaculatus* (Gahan *et al.* 1968).

The 12 insecticides tested against natural infestations over the past two years, with the common names or company designation, chemical name, and acute oral toxicity (LD-50 in milligrams per kilogram) to white rats, are given in the accompanying tabulation.

Of these, Akton, Chevron RE-11775, Chlorphoxim, Ciba C-10015, phoxim, and Bayer 91273 were obtained from commercial sources and along with malathion were tested at the target dose of 2 g/m^2 in barns and poultry houses. Four less promising chemicals—Abate, methoxychlor, Dowco 214, and S. B. Penick 1382—were also included in the field study because of their low mammalian toxicity; these 4 insecticides plus malathion and Bayer 91273 were also evaluated at 4 g/m^2. Propoxur applied at the rate of 2 g/m^2 was used as the standard.

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Common name or company designation	Chemical name	Mammalian toxicity LD-50 in mg/kg to white rats
Abate ®	*O,O'*-(thiodi-*p*-phenylene) *O,O,O',O'*-tetramethyl phosphorothioate	2330
Akton ®	*O*-[2-chloro-1-(2,5-dichlorophenyl)vinyl] *O,O-diethyl* phosphorothioate	146
Bayer 91273	isopropyl salicylate *O*-ester with *O*-ethyl phosphoramidothioate	>1000
Chevron RE-11775	*m-sec*-butylphenyl methyl(phenylthio) carbamate (55 percent in an isomeric mixture)	82
Chlorphoxim		375–>1000
Ciba C-10015	*o*-(4,5-dimethyl-1,3-dioxolan-2-yl)phenyl methylcarbamate	53±25
Dowco 214	*O,O*-dimethyl *O*-(3,5,6-trichloro-2-pyridyl) phosphorothioate	674–2990
Malathion		1375–4000
Methoxychlor		>6000
S. B. Penick 1382	(5-benzyl-3-furyl)methyl *cis-trans*-(±) 2,2-dimethyl-3-(2-methylpropenyl)cyclopropanecarboxylate	600–800
Phoxim		800–9999
Propoxur		104–116

TABLE 1.—Control of *Anopheles quadrimaculatus* in buildings treated with insecticides applied as residual sprays (average of 2–5 replications).

Chemical	Dose (g/m^2)	Formulation	Reduction (%) at indicated weeks posttreatment				
			1	3	5	7	9
Phoxim	4	EC	100	100	100	100	100
	2	WP	100	100	100	99.8	100
Malathion	4	EC	100	100	100	100	98
		WP	100	99.7	99.0	98	100
	2	EC	100	100	100	100	100
		WP	99	99	100	100	100
Bayer 91273	4	EC	100	99.9	99.6	95	99
	2	EC	100	93.5	94	91.5	96
Chevron RE-11775	2	EC	100	93.5	94	91.5	96
Methoxychlor	4	EC	100	98	100	100	100
		WP	98	99.5	99.5	90	95
	2	EC	100	99.5	99	99.8	100
		WP	99	97	94.5	88	97
S. B. Penick 1382	4	EC	100	100	100	100	100
	2	EC	100	93	89.5	90.5	97
Ciba C-10015	2	WP	100	100	94.9	94.5	91.5
Chlorphoxim	2	WP	100	100	99.6	99.7	89.4
Dowco 214	4	EC	100	96.5	96	93.5	98
	2	EC	100	97.3	88	75.7	68
		WP	100	100	96.8	82.3	74.7
Akton	2	EC	100	98.7	79.3	64	49.3
Abate	4	EC	83	30.5	41.5	11.5	38
		WP	95	0	5	14	32
	2	EC	100	68.5	69	59	87
		WP	94	50.5	44	40.5	66
Propoxur (standard)	2	EC	100	99.1	100	100	99

The insecticides were applied as wettable powders (WP) or emulsion concentrates (EC) or both in June 1969 and 1970. Each spray contained 5 or 10 percent insecticide; and two to five buildings were treated with each insecticide by coating all potential resting places on the interior walls, ceiling, and pieces of equipment; the exterior surfaces were left untreated. Since spider webs provide resting places for adult *Anopheles* and sprays do not adhere to them as well as to wood surfaces, those webs that could be easily reached were removed before spraying.

Effectiveness was evaluated by making a total of two pretreatment and five posttreatment counts of the adult *A. quadrimaculatus* present in the sprayed buildings and in 14 untreated buildings used as controls every 2 weeks to determine variations in the normal densities in the area. Most posttreatment observations were made in the afternoons to allow time for the insecticide to affect the mosquitoes. The percentage reduction was determined by comparing the number of *A. quadrimaculatus* observed pretreatment and posttreatment. Counts were terminated the latter part of September when the rice fields were drained, and the reduced number of adults present gave inaccurate information about the effectiveness of the treatments. The results are given in Table 1.

Emulsifiable concentrates of phoxim, malathion, methoxychlor, and S. B. Penick 1382 at 4 g/m^2 and malathion, methoxychlor and wettable powders of phoxim and malathion at 2 g/m^2 were equal to or superior to the propoxur standard (2 g/m^2) in effectiveness. The remaining compounds were less effective than the standard. Since in all instances, treatments were applied to wooden structures rather than to concrete or mud, the surface may explain the greater effectiveness of the emulsions compared with the wettable powders.

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