

EFFECTIVENESS OF DDT AS A RESIDUAL TREATMENT OF BED NETS

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Observations in the South Pacific showed that *Anopheles farauti* Laveran was frequently found hiding in bed nets. So important was this resting place that all troops were warned to take special precautions to eliminate mosquitoes from their nets before retiring. This location was also a favorite resting place in native villages. Obviously, mosquitoes so closely associated with man would be of considerable importance in the transmission of malaria. Data by Gahan *et al.* (1945) demonstrated that DDT sprays applied to the walls of buildings would kill mosquitoes that attempted to rest on the treated surfaces. Tests of a similar nature were made to determine the efficacy of a DDT residue spray on bed nets to kill mosquitoes that attempted to rest in them.

Materials and Methods: A series of regulation bed nets were sprayed with equipment available to malaria control units in the South Pacific. The spray material was 5 per cent DDT in kerosene. One set of nets was sprayed with the cylindrical pressure sprayers (decontamination) equipped with whirl plate nozzles and one set with paint spray guns adjusted to deliver large droplets. The procedure of spraying was to spread the nets and pile them one on top of the other. The top net was sprayed on one side after which it was reversed to start a new pile and then sprayed on the opposite side. The rate of application was 1.0 pint per net with the paint sprayer and 1.5 pints per net with the cylindrical pressure sprayer. The nets were hung in the sun to dry and were then folded and stored for 37 days.

In making the tests, one net that had been treated with each type of sprayer was installed in normal fashion over a bed. Adult, laboratory-reared *Anopheles farauti* were released under the nets. Two types of tests were made. In one, the mosquitoes were left in the nets until all were knocked down, while in the other the exposure period was varied. After being exposed in the nets, the mosquitoes were transferred to clean cages and observed for mortality rate. With the varied exposure times, the observer remained under the net with the mosquitoes. Three exposure times were obtained by transferring groups of the mosquitoes to clean cages 2, 5, and 10 minutes, respectively, after they were placed under the nets. Control insects were released in an untreated net and later transferred to clean cages.

Results: The preliminary tests in which mosquitoes were confined in the nets until all were knocked down showed no difference in effectiveness of the nets treated with the different types of spray apparatus. Nearly all mosquitoes were knocked down in 45 minutes. Only one mosquito out of 94 survived an hour and it was dead by the end of the second hour. None of these mosquitoes recovered and there were no deaths among the controls.

Additional tests with the varying exposures showed, Table 1, that all mosquitoes were dead 24 hours after 2, 5, and 10 minutes exposures to treated bed nets. In fact, 86 to 100 per cent were knocked down within four hours after such exposures. None was dead in the controls.

Discussion: It was noted that the mosquitoes were exceptionally active under the nets and were continually probing with the proboscis as they tried to escape through the meshes. The habit of probing openings as they sought escape holes

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TABLE 1. Percentage of *Anopheles farauti* Laveran knocked down at intervals following exposure of 2, 5, and 10 minutes in bed nets sprayed with DDT-kerosene solutions; Guadalcanal, 1944.

Interval after exposure	Exposure in minutes									
	Decontamination sprayer				Paint sprayer				Check	
	2	5	5	10	2	5	5	10		
	Number of insects									
	22	21	34	34	22	35	20	38	25	27
	Per cent knockdown									
15 min.	6	9	14	15	8	4	6	10	0	0
30 min.	15	9	38	38	26	23	11	20	0	0
1 hour	44	23	52	47	42	41	18	40	0	0
2 hours	71	41	62	76	66	64	40	65	0	0
3 hours	91	64	86	97	87	77	91	85	0	0
4 hours	100	95	100	100	92	86	91	95	0	0
24 hours	100	100	100	100	100	100	100	100	0	0

allowed more DDT to get on them than if they had rested quietly. The mosquitoes began to show definite discomfort and began vigorously to wipe the proboscis within two minutes after being released under the nets. Their legs showed jerking movements and by the end of five minutes typical symptoms of DDT poisoning were evident.

Anopheles farauti appeared to be more inclined to try to crawl through small openings than did *A. quadrimaculatus*. This habit was noted when small individuals were observed to crawl through 16-mesh wire screen. They escaped easily at the corners of the cages and in places where they could wedge their bodies into the wire openings.

Mosquitoes that were liberated under the treated nets with the observer attempted to bite rather freely for a period of about two minutes, but after five minutes none attempted to bite. As soon as the mosquitoes showed definite signs of DDT poisoning they ceased to bite.

These tests show that a residue-DDT treatment of bed nets will effectively knock down mosquitoes that attempt to

rest under the nets. The rapid mortality of mosquitoes exposed for only two minutes indicates that large numbers may even be killed as they crawl about on the outside of the nets in attempts to reach the man underneath. Results of such treatments of bed nets indicated that this is a satisfactory way of killing mosquitoes that rest in them. It provided a method that is adaptable to mass treatments and that does not depend on the action of an individual for his own protection. Treatments of bed nets of natives should be helpful also in reducing the number of infected mosquitoes.

Summary: Tests show that DDT residues on bed nets, treated at the rate of 6 to 8 nets per gallon of a 5 per cent DDT in kerosene, will kill mosquitoes that attempt to rest in the nets. Biting of *Anopheles farauti* stopped as soon as they exhibited symptoms of DDT poisoning, which was two to five minutes after exposure to treated nets.

Reference

- Gahan, James B., Travis, B. V., Morton, F. J. and Lindquist, Arthur W. 1945. DDT as a Residual-type Treatment to Control *Anopheles quadrimaculatus*: Practical Tests. *J. Econ. Ent.* 38:231-235.