

before eggs were deposited. A specimen with such erratic behavior as this could be very misleading in epidemiological investigations involving the use of "gonotrophic concordance."

SUMMARY. Observations on 186 individually isolated females of four species of floodwater mosquitoes (*Ae. vexans*—30; *P. confinnis*—50; *P. cyanescens*—68; and *P. ciliata*—38) at Wilson Dam, Alabama, during 1962-63 emphasize longevity and sequential blood feeding and oviposition behavior. Longevity varied from a mode of 17 days in *P. cyanescens* to 41 days in *P. confinnis*; the longevity mode in *Ae. vexans* was 27 days and in *P. ciliata*, 32 days. *P. confinnis* was exceptionally prolific, depositing a mode of 650 eggs during life as compared to 150, 120, and 100, respectively, for *Ae. vexans*, *P. ciliata*, and *P. cyanescens*. The three *Psorophora* species characteristically required several blood meals (mode, 3-5) before the first

eggs were deposited with a correspondingly long preoviposition period (mode, 13-15 days). *Ae. vexans*, on the other hand, began depositing eggs after the first blood meal and had a short preoviposition period (mode, 5 days). The *Psorophora* species took more (mode, 5-6) and closer spaced blood meals with associated egg depositions (mode, 2-9) than did *Ae. vexans* (mode: blood meals—2; ovipositions—2).

Figures are presented in which specimens showing "typical," "prolific," and "erratic" behavior for each species are represented graphically and collective data for each group are presented in table form.

Reference

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LABORATORY EVALUATION OF CERTAIN LARVICIDES AGAINST *ANOPHELES QUADRIMACULATUS* SAY.

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With the development of resistance to chlorinated hydrocarbons and other chemicals by mosquitoes a wide spectrum of new insecticides has become available. At present there are few data concerning the toxicity of these new substances either to different species of mosquitoes or to various strains within a species. Such information is basic in the choice of insecticides for specific control situations and also for following the development of resistances and cross-resistances in mosquito populations.

This paper presents the dosage-mortality relationships of one recently-collected field strain and one laboratory inbred strain of *Anopheles quadrimaculatus* with respect to

a number of larvicides and candidate larvicides.

MATERIALS AND METHODS. The following strains were utilized in this study:

Dothan: A strain collected in Dothan, Alabama in January 1964; after three generations of laboratory rearing it was utilized in this study. Following World War II, DDT was used extensively in Dothan area to control mosquitoes, house flies and the pests of cotton and peanuts (F. S. Arant, personal communication, 1964).

Bethesda: A strain obtained in 1962 from the Naval Medical Research Institute, Bethesda, where it had been in

culture since 1945 as the "N" strain. According to Stahler and Terzian (1961) the strain originated in Beltsville, Md. as a mixture of (1) the Tallahassee strain which had been received in 1942 subsequent to having been cultured for three years at Orlando, Fla. and of (2) the Orlando strain which had been received in 1944 from Merck at Rahway, N. J. subsequent to having been cultured there for one year.

Larvae were reared at a density of 75-100 in white enamel pans 10 x 12 inches with shallow water and fed daily on a coarsely ground mixture of equal parts of Kellogg's Concentrate, wheat germ and live yeast. This rearing method provided vigorous larvae of uniform size. The adults were maintained in screened cages 12 x 12 x 12 inches in an insectary maintained at 80° F. and 80 percent relative humidity. As a source of blood a guinea pig with shaven back was taped to a pan and offered every day. A wet sponge placed on the top of the cage provided water while a honey-saturated ball of cotton-wool provided energy. Oviposition was accomplished in a water-filled petri dish lined with a strip of filter paper.

Technical or purified insecticide was dissolved in 95 percent ethanol to provide the desired concentration of actual toxicant, except in the case of paris green which was placed, as a powder which passed a 325 mesh screen, into constantly stirred water according to a method suggested by A. J. Rogers (personal communication). The dosage mortality relationships were determined with four replicates at each concentration by the WHO standard method (World Health Organization, 1960) using tap water at 21-23 C. Percentage mortalities were plotted on a probability scale against concentration of actual toxicant on the logarithmic scale. Some of the compounds tested are relatively new and the exact structures of several are as yet undisclosed. These are listed as follows:

Bayer 41831	: o, o-dimethyl o-4-nitro-m-tolyl phosphorothiolate.
Dylox	: o, o-dimethyl 2, 2, 2-trichloro-1-hydroxyethyl phosphonate.
Bayer 37289	: o-ethyl, o-2, 4, 5-trichlorophenyl ethylphosphonothioate.
Zytron	: o-(2-4-dichlorophenyl) o-methyl isopropylphosphoramido = thioate.
Bayer 37344	: 4-(methylthio)-3, 5-xylyl methyl carbamate.
Bayer 39007	: o-Isopropoxyphenyl methyl carbamate.
Dimethrin	: 2, 4-dimethylbenzyl chrysanthemumate.
WARF	: N, N-di-n-butyl-p-chlorobenzenesulfonamide.
deutero-DDT	: 2, 2-bis(p-chlorophenyl)-1, 1, 1-trichloroethane-2-d.
Chemical structures undisclosed	: SD-7438, SD-7587, Bayer 52957, Stauffer N-2404.

RESULTS AND DISCUSSION. Dosage mortality relationships for the larvae of both strains of *Anopheles quadrimaculatus* have been plotted in Figs. 1 and 2. From these figures the LC₅₀ and LC₁₀₀ values were obtained as indicated in Table 1.

DDT when synergized by WARF proved to be more insecticidal at the LC₅₀ level to the Dothan strain than any other compound, while this mixture was only moderately toxic to the Bethesda strain. However at the LC₁₀₀ level of toxicity Stauffer N-2404 proved to be equally as toxic as DDT in WARF to the Dothan strain, and no less toxic than any other compound to the Bethesda strain. Deutero-DDT, Bayer 52957 and American Cyanamid 52160 proved to be extremely toxic to both strains. EPN was equally as toxic as these to the Bethesda strain and nearly as toxic to the Dothan strain. Contrariwise, dicapthion was extremely toxic to the Dothan strain and less toxic to the Bethesda strain.

It may be seen from Figs. 1 and 2 that the Dothan strain is distinctly more heterogeneous than the Bethesda strain with regard to its tolerance to DDVP, naled, Bayer 41831 (Sumithion), guthion, Bayer 37344, Bayer 39007, Dimethrin and Lethane 60. The Dothan strain is seen to be

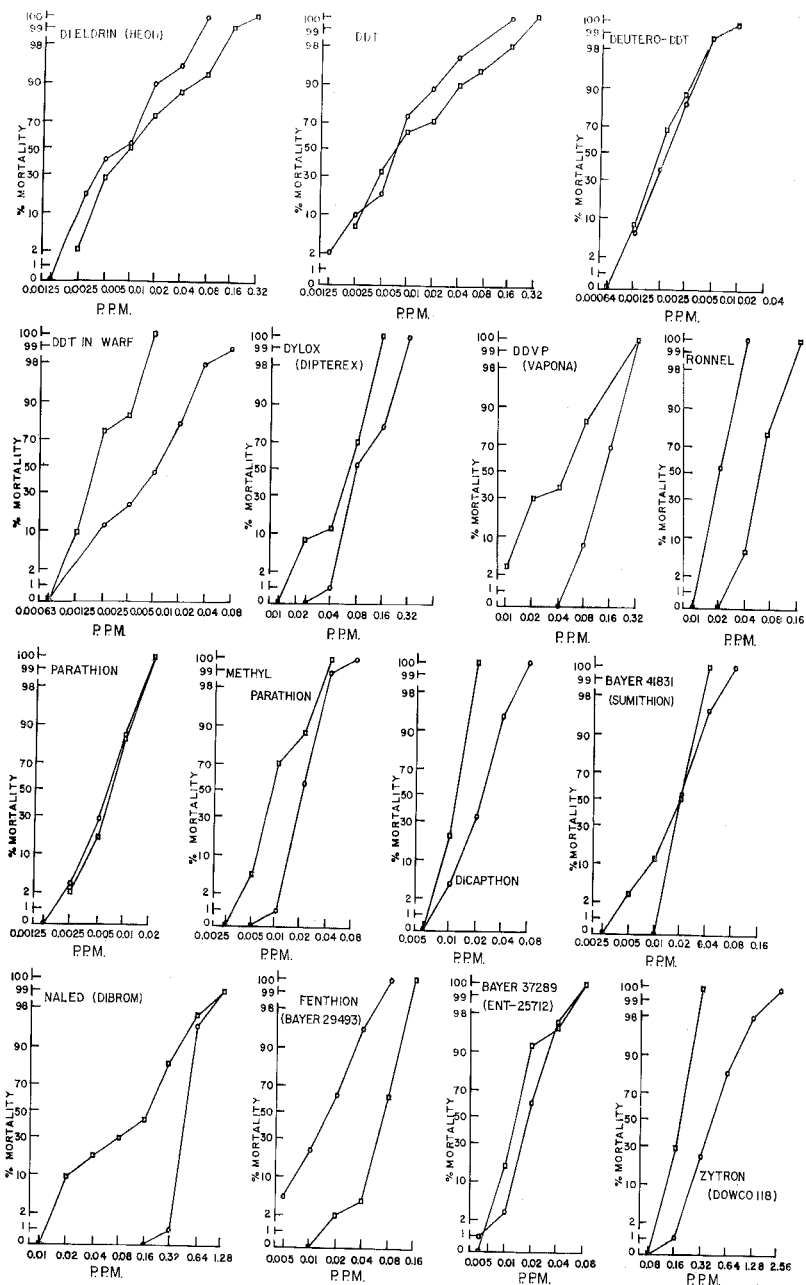


FIG. 1.—Dosage mortality relationships to certain larvicides for fourth instar *Anopheles quadrimaculatus* larvae.

□—□ Dothan strain, ○—○ Bethesda strain

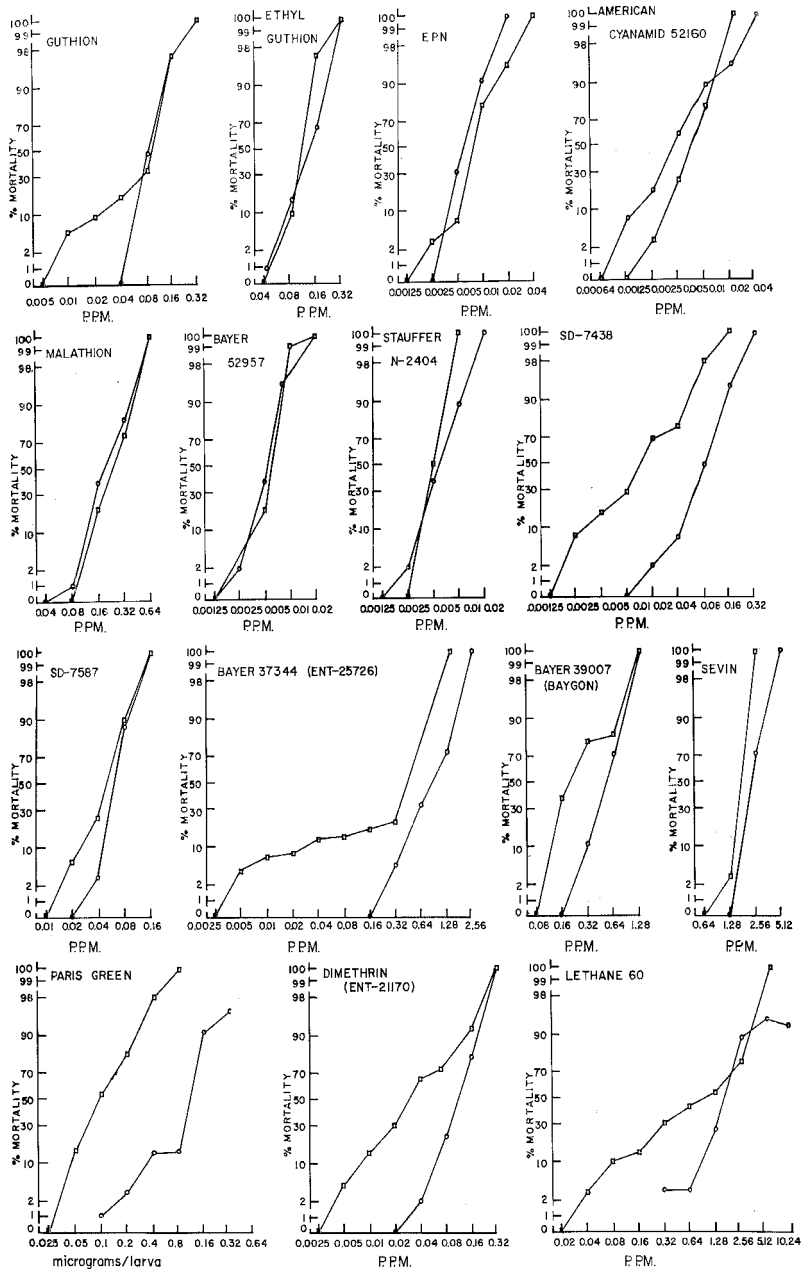


FIG. 2.—Dosage mortality relationships to certain larvicides for fourth instar *Anopheles quadrimaculatus* larvae.

□—□ Dothan strain, ○—○ Bethesda strain

TABLE I.—Toxicity of certain larvicides to the Dothan and Bethesda strains of *Anopheles quadrimaculatus*. LC₅₀ and LC₁₀₀ values are in parts per million.

Material	Dothan		Bethesda	
	LC ₅₀	LC ₁₀₀	LC ₅₀	LC ₁₀₀
<i>Organophosphates and "Undisclosed"</i>				
Stauffer N-2404	0.005	0.01	0.0058	0.02
Bayer 52957	0.006	0.02	0.0054	0.02
Amer. Cyan. 52160	0.0068	0.02	0.0043	0.04
Ethyl Parathion	0.007	0.02	0.0064	0.02
EPN	0.0078	0.04	0.006	0.02
Methyl Parathion	0.0085	0.04	0.019	0.08
Dicaphthion	0.012	0.02	0.024	0.08
Bayer 37289	0.013	0.08	0.018	0.08
SD 7438	0.015	0.16	0.082	0.32
Bayer 41831	0.02	0.04	0.19	0.04
DDVP	0.048	0.32	0.14	0.32
SD 7587	0.05	0.16	0.062	0.16
Ronnel	0.058	0.16	0.019	0.04
Dylox	0.063	0.16	0.079	0.32
Bayer 29493	0.072	0.16	0.016	0.08
Methyl Guthion	0.089	0.32	0.082	0.32
Ethyl Guthion	0.11	0.32	0.13	0.32
Zytron	0.18	0.32	0.43	2.56
Dibrom	0.18	1.28	0.48	1.28
Malathion	0.24	0.64	0.19	0.64
<i>Chlorinated Hydrocarbons</i>				
Deutero-DDT	0.0024	0.02	0.0029	0.02
DDT in Warf(1:1)	0.0020	0.01	0.011	..
DDT	0.0074	0.32	0.0074	0.16
Dieldrin	0.0098	0.32	0.0082	0.08
<i>Carbamates</i>				
Bayer 39007	0.02	1.28	0.52	1.28
Bayer 37344	0.77	1.28	0.86	2.56
Sevin	1.72	2.56	2.3	5.12
Dimethrin	0.029	0.32	0.11	0.32
Lethane 60	0.92	5.12	1.5	10.24
Paris Green ($\mu\text{g}/\text{larva}$)	0.094	0.8	1.2	..

notably more tolerant than the Bethesda strain to dieldrin, DDT, ronnel and Bayer 29493 (fenthion); while the Bethesda strain is seen to be the more tolerant to SD-7438, Sevin, Bayer 37344 and paris green.

The presence in the Dothan strain of individuals that are unusually tolerant to DDT and dieldrin suggests that the field application of these chemicals has resulted in selection for the tolerant individuals. The significance of its tolerance to ronnel and fenthion is obscure since it is not known whether these chemicals were used in the Dothan area. Both strains utilized in this study proved to be more susceptible to Bayer 41831 and SD-7587 and more tolerant to guthion and fenthion (Bayer

29493) than the strain employed by Jakob and Schoof (1963).

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