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EFFICACY OF DIFFERENT MALATHION FORMULATIONS APPLIED TO DIFFERENT LOCI IN *PERIPLANETA AMERICANA* L. (DICTYOPTERA: BLATTIDAE)

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ABSTRACT

Technical malathion, malathion in acetone and malathion in benzene were applied at different loci to both sexes of *Periplaneta americana***.** The effects were measured, and three main conclusions were drawn: (1) males are affected quicker than females; (2) the forefemur is the most effective site of application; and (3) mala- thion in benzene is more effective than malathion in acetone or undiluted mala- thion. The probable explanations for these observations are discussed.
KEY WORDS: malathion, knockdown, sensitivity,*Periplaneta americana.*

INTRODUCTION

There is a correlation between mortality and the site of application of an insecticide in different species of insects. This may be due to one or more factors including the differential penetration of the insecticide at different sites of application, and different rates at which the insecticide moves to the site of action inside the body. Hence, the determination of a site which gives maximum mortality due to application of an insecticide, might be of great importance in obtaining maximum effect of the pesticide. It is with this view that the present investigation was undertaken to determine the most suitable and effective site for the application of malathion in both sexes of *Periplaneta americana.*

MATERIALS AND METHODS

Newly emerged adult *Periplaneta americana* L. from an inbred colony were treated with malathion [0, 0-dimethyl - S - (1, 2 - dicarboethoxy - ethyl) phos- phorodithioate] applied in three formulations: 1) technical grade malathion (purity 98.7%; product of Bharat Pulverising Mills, Bombay), 2) technical malathion dissolved in acetone (1, 2 and 5%), 3) technical malathion dissolved in benzene (1, 2 and 5%). Ten microlitres of each of these concentrations (including undiluted technical grade malathion) were applied topically to the pronotum, second thoracic sternite, wingbase and forefemur to both sexes, and the mean time required for the complete knockdown

of the insect was calculated. Undiluted technical malathion was also applied to the compound eye. Ten insects were used for each treatment. The control insects were treated with the solvent alone.

RESULTS AND DISCUSSION

The results are presented in figures 1-3, from which the following conclusions are drawn: 1. The period required for a complete knockdown is shorter when application of the three formulations is made to the forefemur than to other sites (Fig. 1). 2. Knockdown time varies among the three formulations when applied to the same site, being faster with benzene solutions of malathion (Figs. 2-3). 3. Knockdown time occurs sooner in males than in females with all three formulations (Figs. 1-3).

Knockdown response has been correlated in the past with the distance from the site of application of the chemical to the site of action, i.e., the shorter the distance, the greater the effect (Gerolt, 1970). Since the site of action of malathion is the brain (Saxena, 1982; Saxena and Saxena, 1984), the response should have been quicker when this chemical is applied to the compound eye or to the pronotum as they are situated nearer to the site of action. This actually did not happen, and upon using solutions of malathion, the more distantly located sites, such as the forefemur and 2nd thoracic sternite had shorter knockdown time than the pronotum. Furthermore, knockdown response was comparatively quicker when technical malathion was applied to the pronotum, a more sclerotized site, than to the wingbase and abdomen, contrary to the findings of Hoskins (1963). This quicker response may be due to the higher concentration of technical malathion than of its two solutions. Also the penetration of malathion at various sites of application was enhanced to a greater degree by benzene than by acetone, as evidenced from knockdown times (Figs. 2-3).

It is to be noted, however, that benzene may cause some injury to the cuticular sublayers (Saxena and Saxena, 1982), thus effecting faster penetration of the toxicant.

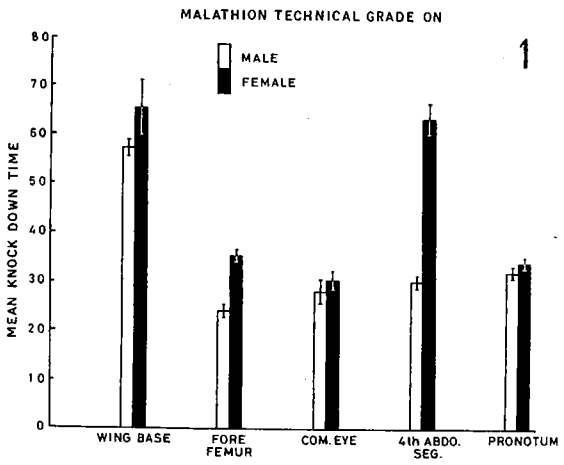
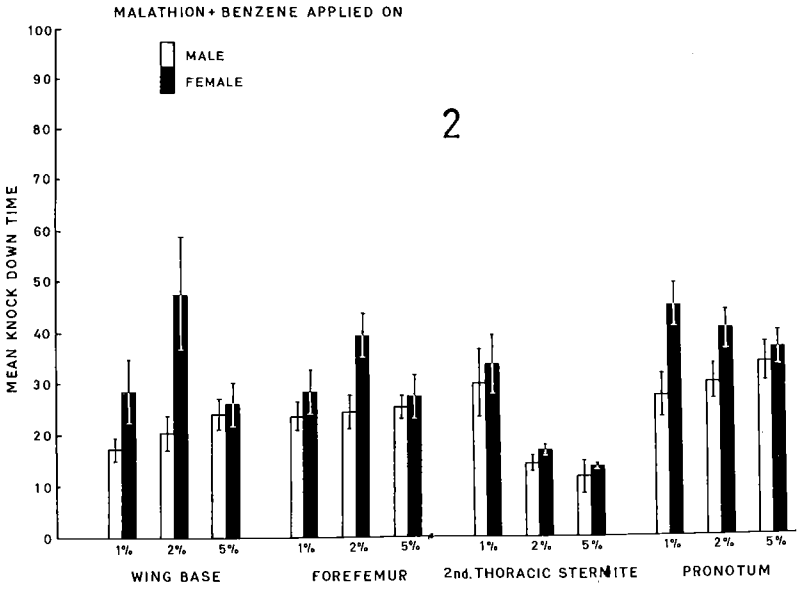
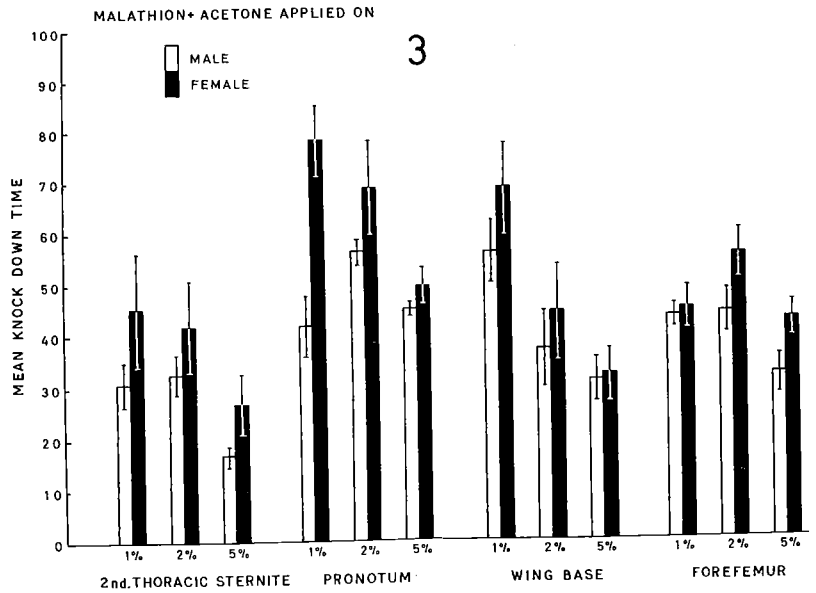


Fig. 1. Mean knockdown time (in minutes) of *Periplaneta americana* after treatment with malathion (technical grade) at different loci. (bars show standard error)





Figs. 2-3. Mean knockdown time (in minutes) of *Periplaneta americana* after treatment at different loci. 2. With malathion in benzene. 3. With malathion in acetone. (bars show standard error)

Benzene itself had no toxicological manifestations when applied to controls (no knockdown for 18 hours). Acetone too has been found ineffective with regard to the toxicological manifestations (no knockdown for 24 hours).

Technical malathion is a poor penetrant through the cuticle or to the site of action via the haemolymph. Hence, its longer knockdown time, although direct comparisons cannot be made because of the concentration differences.

Lastly, it is quite evident that males are more susceptible to knockdown than females, regardless of the locus of application (Figs. 1-3). This might be due to differences in pigmentation, i.e. structural resistance (Perry and Agosin, 1974) and lipid content of the cuticle (Krammer and Wigglesworth, 1950; Dennell and Malek, 1954). There might also be biochemical differences unrelated to anatomical or permeability factors.

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