Malaria Research Lead Programme

Lab Evaluation Of Residual Activity Of Different Insecticides For The Control Of Malaria Vectors. Bayer 2008

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Medical Research Council

The work described in this report is being carried out in the Durban laboratories of the Malaria Research Programme of the Medical Research Council and was commissioned for Bayer.

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INTRODUCTION

The aim of this study is to evaluate the residual efficacy of a number of different insecticides on various surfaces under controlled conditions in the laboratory.

An. arabiensis is a primary vector of malaria in numerous parts of Africa (White, 1974) and is the predominant malaria vector species in South Africa (Sharp and le Sueur, 1991), making it an obvious choice as test species.

The substrates used are representative of those found in structures in the field, i.e. mud daub, cement and painted cement plaster.

MATERIALS AND METHODS

Each insecticide was suspended in water according to the manufacturer's instructions and appropriate amounts were sprayed onto the various target types using a calibrated Potter's Spray Tower. Bioassays (1 hour exposure) were carried out on the sprayed surface with blood-fed female *Anopheles arabiensis*. At 30 minutes the mosquitoes were observed for knockdown and again at 60 minutes (WHO, 1963).

After 60 minutes of exposure the mosquitoes had been removed from the substrate and transferred to a holding cage, which was placed in the insectary.

A nutrient solution was accessible to mosquitoes and after 24 hours the number of dead mosquitoes had been recorded and percentage mortality calculated.

The insecticides tested were:

K-Orthrine WP 50 (25 mg/$m^{2)}$
K-Orthrine WG 250 (20 mg/m^2)
Ficam VC 800 WP (400 and 200 mg/m^2)
Bendiocarb 750 WG (400 and 200 mg/m^2)

RESULTS:

Results of bioassays are shown in Figures 1 – 3.

Mud surface (figure 1):

PVA surface (figure 2):

Cement surface (figure 3):

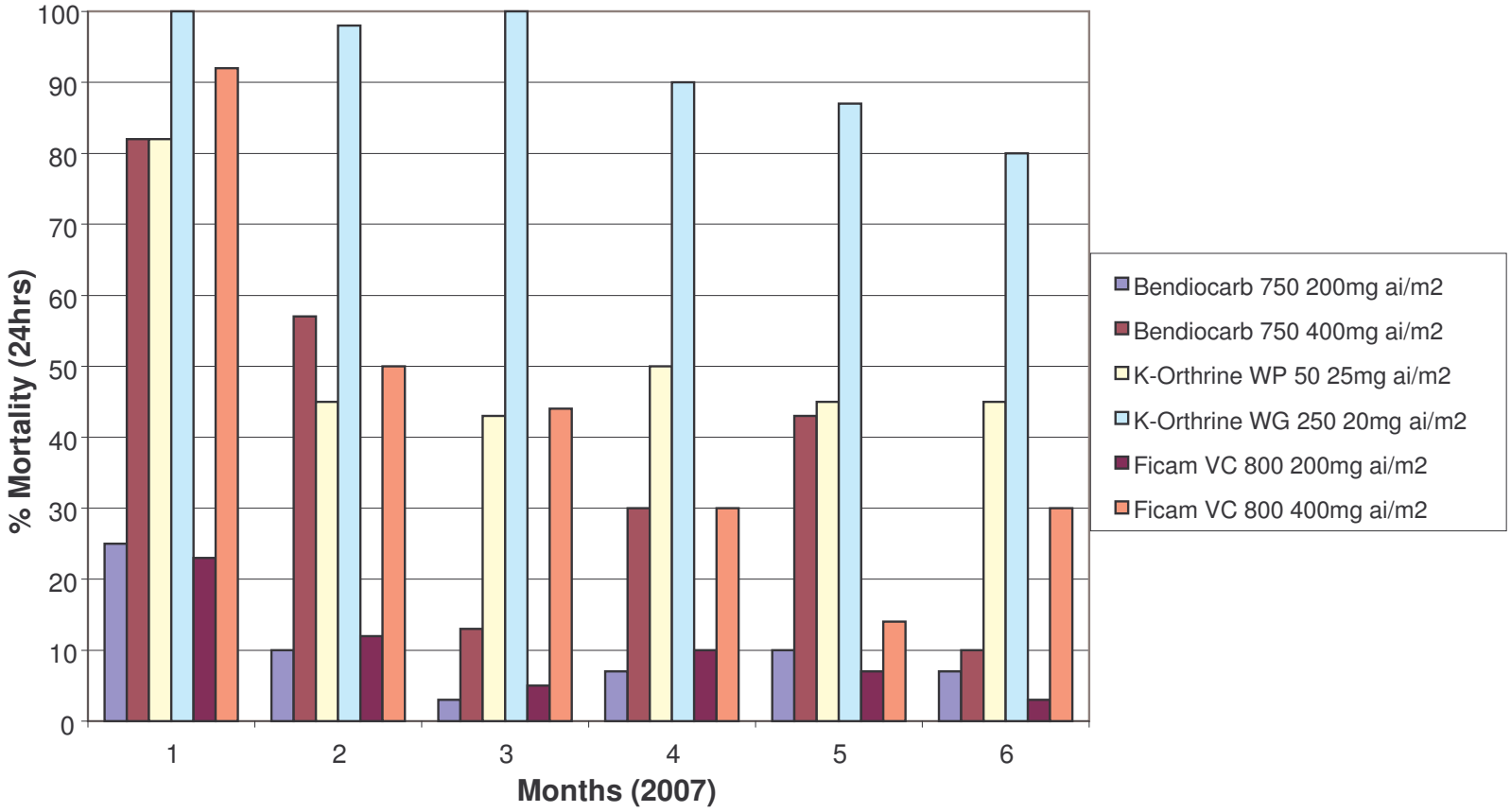

Figure one: Insecticides tested on Mud surfaces

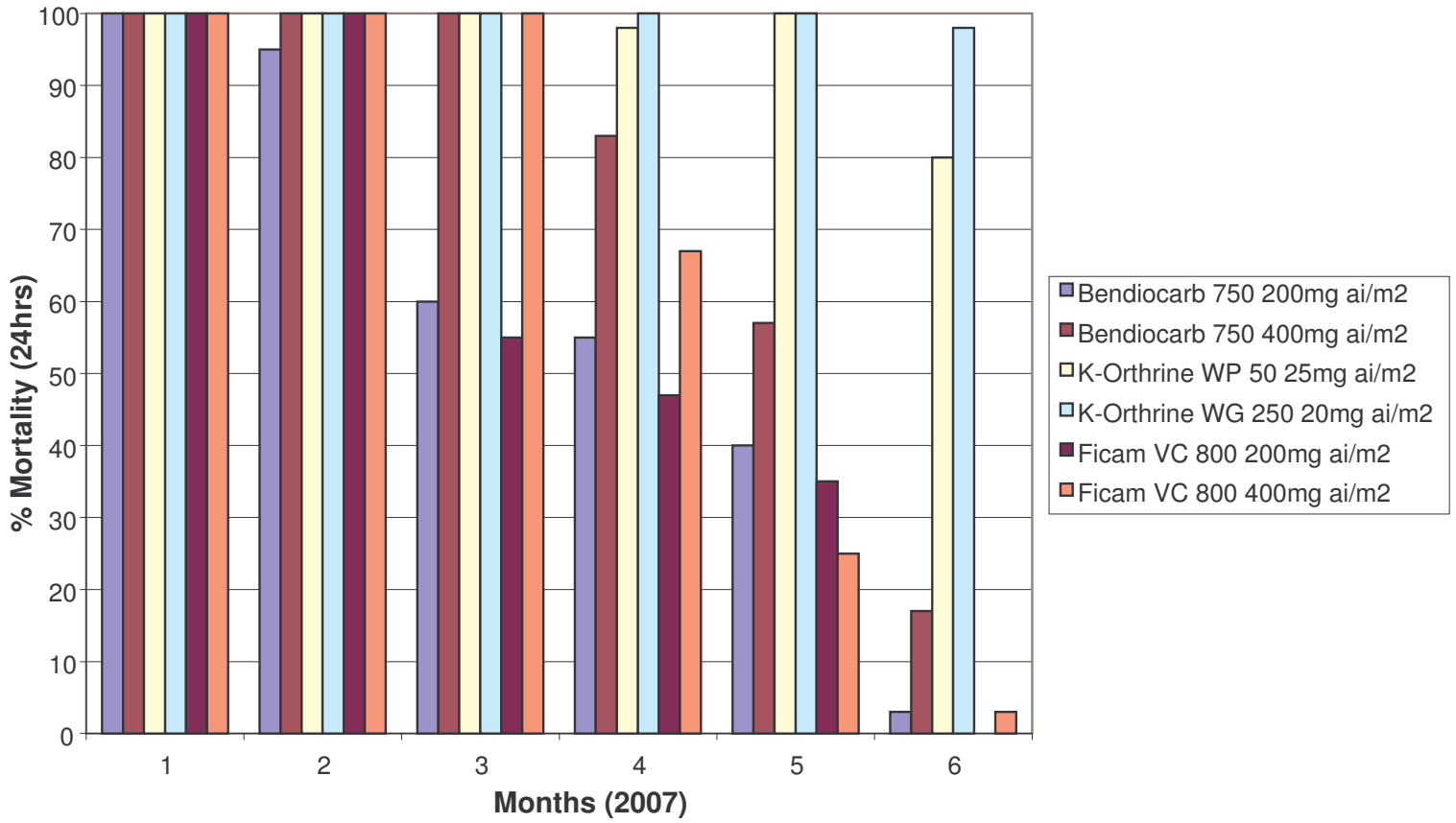

Figure Two: Insecticides tested on PVA surfaces

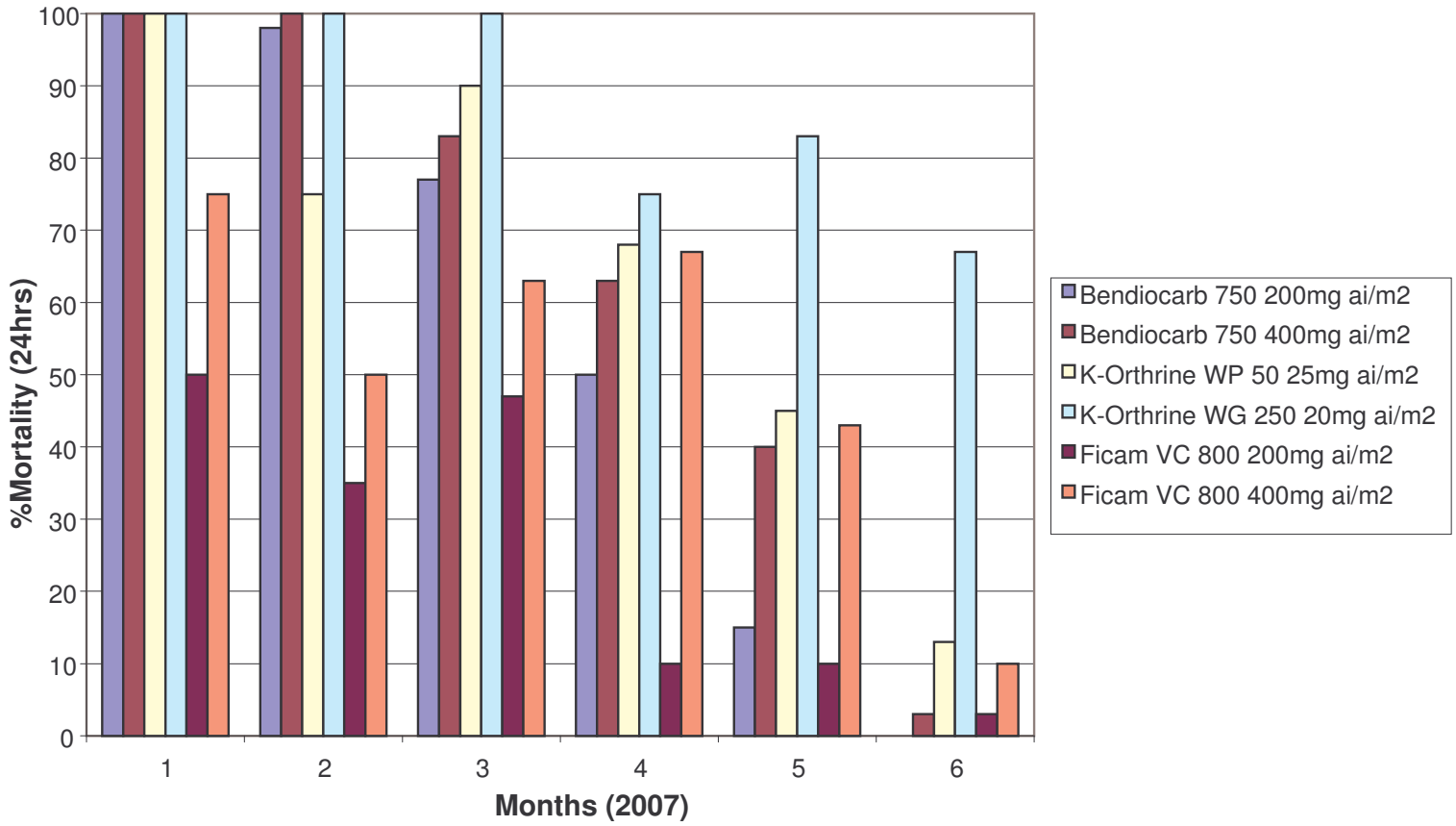

Figure Three: Insecticides tested on Cement surface

Results

Efficacy testing of different insecticides had been conducted in the lab for a period of six months using laboratory strain susceptible mosquitoes.
To ensure that the trial has been performed under controlled conditions a negative control assay had been included using each substrate. All trials were duplicated to ensure validity of results.

Mud

Figure one shows that Bendiocarb 750 (200mg/m^2) had not exhibited high activity against the test species since mortality had decreased from 25 % to 7% mortality over six months. Bendiocarb tested at 400mg/m^2 had initially produced a high mortality of 82 % however it did not sustain its effectiveness and activity declined to 10 % mortality within six months of testing.

K-Orthrine WP had also produced 82 % mortality during the first three months and had also decreased in activity by the sixth month with a mortality of 45 %.
K-Orthrine WG had continued to produce high mortality for six months post exposure with mortality reaching 80% at the sixth month.

Ficam VC (200mg/m^2) did not perform well as mortality decreased from 23% to 3% during the six month trial. When tested at a rate of 400mg/m^2, high activity was observed during the first month with 92 % mortality. A steep decline in mortality had been noticed by the second month with mortality reaching 50% and thereafter decreased further to 30% mortality by the 6^{th} month.

Painted cement

Referring to Figure two, Bendiocarb 750 (200mg/m^2) had produced high mortality for the first two months and had thereafter shown a decrease in activity. When tested at a higher rate (400mg/m^2) a much more significant effect on the test species was observed. The first four months of testing had shown high mortality however a loss in activity was noticed by the fifth month with mortality reaching 17%, 6 months post spraying.

K-Orthrine WP and WG had produced outstanding results with high mortality observed for the entire 6 months of testing.

Ficam VC had also been tested using two concentrations (200mg/m^2 and 400mg/m^2). The lower concentration had produced good results for the first two months with a mortality of 100%. Results of trials conducted by during the following months had shown a major decrease in activity with the insecticide having no little or no effect on the test species. The higher concentrations had produced 100 percent mortality over the first three months and had subsequently decreased resulting in 3 % mortality by the 6^{th} month.

Cement

Bendiocarb 750 at a rate of 200mg/m^2had shown excellent results during the first two months of testing however a loss in activity was noted by the third month reaching 77 % mortality and decreasing further by the sixth month. When tested at a rate of 400mg/m^2Bendiocarb maintained high mortality for a period of three months ranging between 83 to 100%. A noticeable decline in activity was observed after the third month of testing.

K-Orthrine WP 50 produced high mortality for the first three months of testing however decreased in activity thereafter. K-Orthrine WG maintained its efficacy for five months of testing and had decreased to 67% mortality by the sixth month.

Ficam VC had produced an initial mortality of 50% during the first month of testing. This effect had not lasted as the mortality was inconsistent and had decreased to 3% by the sixth month. When tested at a higher concentration (400mg/m^2), an initial mortality of 75% was observed in the first month post spraying and thereafter a loss in activity was observed by the inconsistent results produced.

The positive control results for mud and painted cement substrates had produced 100% mortality throughout the six months of testing. The cement substrate had shown high activity however a gradual decline in mortality had been observed by the fourth month.

Discussion

Comparing all three substrates, painted cement has retained its high efficacy for longer time, post treatment. Cement had shown high residual efficacy for specific insecticides whereas mud had not produced significant results.

Evaluation of the results has shown that of all the insecticides tested, K-Orthrine WG 250 and had maintained its high activity on all three substrates over the six months. Bendiocarb WG 750 was effective at high concentrations on all three substrates however it did not have the ability to maintain its residual activity.

K-Orthrine WP 50 had induced high mortality in cement and painted cement substrates, whilst Ficam VC had only shown significant activity at higher concentrations on the painted surface.

It is apparent that the wettable grade insecticides have a greater effect on the test species for a longer period compared to the wettable powder. K-Orthrine WG 250 has therefore produced the best results compared to the other insecticides.

References:

Le Sueur. D.,Sharp B.L.,Fraser C., Ngxongo S.M.(1993) Assesment of the residual efficacy of Lambda-Cyhalothrin 1. A Laboratory study using *Anopheles arabiensis* and *Cimex Lectularius* (Hemiptera: Cimicidae) on treated daub wall substrates from Natal, South Africa.Journal of American Mosquito control Association,9(4):408-413

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