

FIELD TRIAL OF BIFENTHRIN AS AN EFFECTIVE INSECTICIDE FOR THE CONTROL OF MALARIA VECTORS

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Malaria is a parasitic disease with an increasing prevalence world-wide, particularly in the developing tropics (WHO, 1997). Malaria remains a major cause of morbidity and mortality in 90 countries resulting in 1.5-2.7 million deaths per year, mainly among children less than 5 years of age (Severson, *et al*, 1999). Anemia is one the most serious consequences of malaria in young children in tropics, particularly in countries where a high level of chloroquine resistance exists. Current efforts to limit or prevent transmission of this disease are increasingly hampered by a number of factors. Firstly, efforts to develop vaccines against malaria parasites remain unlikely to achieve success in the foreseeable future. Secondly, the emergence of ant malaria drug resistance among *Plasmodium*, the causal organism for, has reduced the effectiveness of drugs as prophylactic and treatment agents. Third, deteriorating socioeconomic conditions in many endemic areas have resulted in the collapse of once-effective disease monitoring and control programmes. Fourthly, mosquito control effects are increasingly reduced through the loss of established mosquito control program and the rapid development of insecticide resistance in mosquito populations. Nevertheless the transmission to human of malaria parasites is totally dependent upon the availability of competent of mosquito vectors, as such mosquito control remains the most successful mechanism for disease prevention. An alternative strategy for controlling mosquito-borne diseases would involve use of insecticides as residual spray of impregnated bed nets (ITNs).

The ability of insect population to evolve resistance to every class of insecticide that has been developed often leaves control programmes with few options. Thus, several synthetic pyrethroid insecticides are being developed and some are at different trial stages of WHO Pesticide Evaluation Scheme (WHOPES). The main objective of WHOPES is to study the properties of the products and their impact on vector and/or pest population. Therefore, safety, determination of the application dose (formulation), residual activity on different surfaces, efficacy in different ecologically settings, ease of application, acceptability, resistance assessment and cost effectiveness are the main objectives of the programme (WHO 1995). Summary of result of the analysis of Bifenthrin insecticide on the control of malaria vector is presented.

Phase III field trial of bifenthrin 10 WP, a new synthetic alpha-cyano parathyroid insecticide has shown to be equally effective on the control of malaria vectors. The main objective of this trial was to evaluate the efficacy of *Bifenthrin 10 WP* on the control malaria vectors. The trial was designed and executed in the malaria endemic area in Flores Island, Indonesia from October 1997 to August 1998. Four villages were included in the trial. Two of these villages were sprayed with Bifenthrin at the target doses of 25 and 50 mg/m² respectively. In order to assess performance of Bifenthrin against other pyrethroid, Lambda-cyhalothrin (ICON) at a dosage 25 mg/m² was used, while the fourth village used as a control. Both entomological parameters and malariometric information were collected from these villages. The findings of the trial are very encouraging as presented in this article.

The indoor man-biting rates of *Anopheles subpictus* were reduced by 80% after residual spraying with Bifenthrin 10 WP insecticide at target dose 25mg/m², whereas the outdoor biting rates reduced by 50%. Spraying at the dose of 50mg/m² reduced the indoor biting rates by 55% and 75% outdoor biting rates. The indoors man-biting rates of *An. sudaicus* was reduced by 100% and 95% caught biting the houses.

The indoor day-resting density of malaria vectors was reduced by 94%. There was no noticeable fall in the indoor day-resting in the control village. The results showed a strong agreement with the observations by Yadava *et al* (1996) in India, where Cyfluthrin WP insecticide sprayed indoors at dose of 15 mg/m² in Gujarat state changed the indoor day-resting density of *Anopheles culicifacies* from 37.3 (pre-spraying) to 6.9 and 4.4 after spraying. Percentage reductions were 88%, and 92% respectively. Also the residual spray with Cyfluthrin at 25 mg/m² reduced the indoor resting density of mosquito vectors from 3.0 to 0.05 per man/hour, with a percentage reduction of 83.3% and 93% respectively.

After residual spray, the indoor porous rate of *An. subpictus* were reduced to 38%, 18% and 42% in April, June and August respectively whereas, the corresponding porous rate in the control village remained high, i.e, 68%, 50%, and 80% this shows a strong indication of effect of the insecticide on survival rate of malaria vectors (the survival rates of the malaria vectors were significantly reduced). Whereas, the outdoor

parous rates of *An. subpictus* after spraying with Bifenthrin 50 mg/m² were 44%, 19%, and 0% in April, June and August respectively, but the corresponding outdoor parous rates in the control village were 65%, 100% and 39% in April, June and August respectively.

Bioassay tests have shown that Bifenthrin has a long residual activity on different surfaces and the residual effectiveness remained longer than 4 months after spray. There was a significant reduction in mortality rate over time (Df = 6, F = 4.452, P = 0.01343), (Df = 5, F = 22.093, P < 0.0004) and (Df = 5, F = 13.465, P = 0.00036) after spraying with Bifenthrin (50 Mg/M²), Bifenthrin (25 Mg/M²), and Lambdacyhlothrln (25 Mg/M²) insecticides respectively.

The malaria prevalence rates among school children within 7 months after residual spray, were significantly reduced from 48% to 2%. Comparing to Lambdacyhalothrin (25mg/m²) the prevalence of malaria was reduced from 72% to 25%. Therefore, there was a significant change with time (reduction) of malaria prevalence rates after spraying with Bifenthrin insecticide (F= 5.1907, P = 0.0029, Df= 6).

Whereas, the prevalence rates of malaria in the control village remained high within the range of 76% to 60% for the entire period of 7 months (from February to August).

In conclusion therefore, *Bifenthrin 10 WP* has shown potentially characteristics of public health applications as an indoor residual insecticide, suitable for control of Malaria vectors due to its:

1. Significant reduction of manlanding densities, infectivity and parity rates of malaria vectors.
2. High reduction of the local transmission rates of malaria.
3. Increased ability to bind tightly to organic surfaces resulting in longer residual.
4. Increased tactile availability to the vector from vapor pressure resulting in better efficacy.
5. Virtually insoluble in water resulting in less off-target contamination.
6. Classed as an alpha -cyano pyrethroid with less skin and respiratory irritation, hence acceptable to the society, These properties justify the inclusion of Bifenthrin 10 WP for the control of malaria vectors.

References

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