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RESIDUAL EFFECT OF LAMBDACYHALOTHRIN (ICON 10% WP) ON DIFFERENT SURFACES IN SOUTH OF IRAN

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Abstract

An investigation was made to study the residual activity and air-borne effect of lambdacyhalothrin (Icon 10 WP) at 30 , 40 and 50 a.i. mg/m^2 against *An.stephensi* in hut scale trials on different surfaces in Mamasani , and Rudan, south of Iran. Bio-assay contact mortality test with Icon at 30 a.i. mg/m2 on plaster, cement and wood surfaces decreased from 100% to 51.4%, 53% and 63.8% after 84, 80 and 107 days of hut spraying respectively. At 40 a.i mg/m^2 Icon showed longer residual activity than the 30 mg/m^2, i.e. the mortality rate decteased from 100% to 50.7% for plaster, to 52.5% for cement and to 53.5% for wood surfaces, after 105, 105 and 124 days of hut spraying respectively. Icon at 50 a.i. mg/m^2 showed longer residual activity than the former dosages, i.e. the mortality dropped from 100% to 62.1% for plaster, to 50.7% for cement and to 90.4% for wooden surfaces, after 124 days of hut spraying respectively.

The result of air horne tests showed that Icon has negligible or slight killing effect on *An.stephensi*, i.e. at 30. 40 and 50 a.i. mg/m^2, the mortality rates dropped from 100% to about 60% after 10, 15 and 25 days of hut spraying, respectively.

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Based on the results of this study, lambdacyhalothrin at 50 mg/m^2 has a residual activity for more than 4 months on different sufaces. It could be concluded that, lambdacyhalothrin at 50 mg/m^2 might be a candidate dosage for continuation of study in village scale trial in south of Iran.

Introduction

There is a continuing need for testing new chemical insecticides for vector control because of development of physiological resistance to some of currently used insecticides.

In southern Iran *Anopheles stephensi* Liston has been known to be resistant to DDT (Mofidi et al., 1958). dieldrin (Mofiedi, 1960) and malathion (Manouchehri et al., 1977). After appearance of malathion resistance in *An.stephensi*, propoxur as a residual insecticide was substituted and it was used for 13 successive years since 1978. Subsequently from 1991 for two years, both propxur and actellic were used for malaria control in south of Iran (two rounds per year).

Long term use of insecticides for vector control in south of Iran has shown that, *An.stephensi* as a multiple resistant strain has a good ability to develop resistance to different insecticides. In order to avoid the further development of insecticide resistance to this species, evaluation of some new insecticides and regular monitoring of resistance in an insecticide resistance managment, have the main priority in vector control programmes in Iran.

Pyrethroid insecticides have recently been received considerable attention as candidate chemical for house spraying in malaria vector control. Lambdacyhalothrin (Icon) belong to pyrethroid insecticides is a new candidate insecticide for malaria vector control, it is a contact and stomach insecticide, effective on a wide range of agricultural and public health pests (WHO 1990). Icon has long residual activity and also effective at very low rates of application , compared with conventional OPs and carbamates (Barodji et al., 1989; Htein et al., 1994 and Prasittisuk et al., 1992).

This report is dealing with the residual activity of lambdacyhalothrin (Icon) on different surfaces for malaria vector control in south of Iran in a hut-scale trial.

Materials and Methods

Insecticides: Lambdacyhalothrin available under trade name Icon (10 WP) was supplied by Zeneca Public Health, UK. The Icon (10 WP) was provided in water soluble sachets of 62.5 gr suitable for one spray tank to mix with known volume of water and applied at recommended rates.

Trial area and spraying operations: The hut trials were simultaneously carried out in two different parts of Iran on different surfaces such as plaster, cement and wood, from 22nd of May 1992 for 4 to 5 successive months (the huts were sprayed on 22nd of May) as follows:

(1) Dimemil, a village in Mamasani, south east of Iran, representative of warm and dry climate with a temperature of 30-40 C and relative humidity of 50-60%.

(2) Rudan, a village in Minab, costal area of Persian-Gulf, representative of warm and humid climate with a temperature of 30-40 C and relative humidity of 80-90%.

Husdon X-pert compression sprayer holding 10 litters suspension were used for the application of insecticide to spray 250 m^2 surfaces.

Bioassay tests: To determine the residual effect of Icon at 30,40 and 50 a.i mg/m^2 on different sufraces like plaster, cement and wood, bioassay tests were carried out against blood fed of adult females of *An.stephensi* (4-5 days old). The adults were provided from our insectary in Kazeroun and Bandar - Abbas Training Centre (KTC & BTC). The bioassay tests were carried out according to the method recommended by WHO, using plastic conical chamber (WHO, 1963). In this assay the effective residual activity of insecticide was caluculated based on decrease of mortality of *An.stephensi* from 100% to about 60 to 65% during the hut scale trial.

In order to ivestigate the contact effect of Icon on different surfaces, the total number of 10 adult females of *An.stephensi* were released into each plastic chamber by means of an aspirator and held for 30 minutes (10 replicates). At the end of exposure time, the adultes were transferred into clean paper cup and mortalities were recoreded, following 24 hrs of holding time. The vapour toxicity of Icon in treated rooms was also assessed, using a metal cylinder cage covered with metal mosquito netting with dimensions of 16 and 10 cm for height and diameter, respectively (WHO, 1963). Twenty five adult females of *An.stephensi* were released into each cage and the cages were hanged on the 4 different corners of ceiling, at distances of about 50 cm apart from the wall and ceiling for treated and untreated rooms. The vapour effect of Icon on *An.stephensi* was studied, using mortality rates after 6 hrs of exposure time followed by 24 hrs of holding time.

Results

The result of bio-assay tests with Icon at 30, 40 and 50 mg a.i./m^2 against *An.stephensi* on different surfaces are presented in Figs 1-3.

Plaster sufraces:

The result of bio assay tests with Icon at 30, 40 and 50 mg/m^2 on plaster sufraces are presented in Figs 1-3. At 30 mg/m^2, the mortality rate ranged between 100 to 95.5%, up to 58 days after spraying. At the following days the mortalities gradually began to decrease and it reached to 51.4%, after 84 days of hut spraying. At 40 mg/m^2, Icon showed higher activity than the 30 mg/m^2, i.e. the mortality declined from 100% to 50.7% after 105 days of hut spraying. Icon at 50 mg/m^2 showed longest residual activity than the later rates, i.e. up to 92 days after spraying the mortalities remained between 100% to 95.3%. On the subsequent days the residual activity gradually began to decrease and mortality rate reached to 62.1% after 124 days of hut spraying.

Cement surfaces:

The result of bio-assay tests with Icon at 30, 40 and 50 mg/m^2 on cement sufaces are presented in Figs 1-3. At 30 mg/m^2, 80 days after spraying, the mortality rate decreased from 100% to 53. Higher activity was observed when the Icon was tested at 40 mg/m^2, i.e. the mortality decreased from 100% to 52.5 after 105 days of hut spraying. Icon at 50 mg/m^2 showed longest residual activity than the later rates, i.e. the mortality rate dropped from 100% to 50.7%, after 124 days of hut spraying.

Wooden surfaces:

The result of bio-assay tests with Icon at 30, 40 and 50 mg/m^2, on wooden surfaces are presented in Figs 1-3. At 30 mg/m^2, the mortality rate ranged between 100 to 95.9%, up to 58 days after spraying. At the following days the mortalities gradually began to decrease and it reached to 63.8%, after 107 days of hut spraying. At 40 mg/m^2, Icon showed higher activity than the 30 mg/m^2, i.e. the mortality decreased from 100% to 53.4% after 124 days of hut spraying. Icon at 50 mg/m^2 showed longest residual activity than the later rates, i.e. up to 124 davs after spraying the mortalities ranged between 100 to 90.4%.

Vapour effect:

The air borne efficacy of Icon at 30, 40 and 50 mg/m^2, against *An.stephensi* was studied in hut scaletrial. At 30, 40 and 50 mg/m^2, the mortality rates decreased from 100% to 60%, 65% and 61% after 10, 15 and 25 days of hut spraying respectively.

Discussion:

Based on the results of this study, bio-assay mortality tests on *An.stephensi* with Icon at different rates of appliction, indicated that, Icon at 30 mg/m^2 in south of Iran has a residual activity for about 70 days (62% to 65% mortality) on plaster and cement and 107 days (64% mortality) on wooden surfaces. At 40 mg/m^2 Icon showed higher residual activity than the 30 mg/m^2, i.e the residual activity increased to 94 days (62% mortality) on plaster, to 80 days on cement (62% mortality) and to 118 days (65%) on wooden surfaces.

At 50 mg/m^2 Icon showed longest residual activity than the later rates, i.e. the residual activity on plaster increased to 124 days(62% mortality), to 120 days on cement (65% mortality) and to more than 124 days (90.4% mortality) on wooden surfaces. The results of air borne efficacy of Icon at 30, 40, and 50 mg/m^2 indicated that Icon has a fumigation effect for about 10,15 and 25 days respectively, when the adults were exposed for 6 hrs followed by 24 hrs of holding times (the bioassay mortality ranged between 62% to 65%).

Barodji and his co-workers (1989), in a village scale trial, evaluated the residual effect of Icon (10 WP) at a rate of 25 mg/m^2 against *An.aconitus* on different surfaces in central Java. Mortalities remained above 70% on wood surfaces for about 15 weeks in the first spray round and for 21 weeks in the second spray round. In air bio-assay test, Icon showed negligible fumigant effect.

Htein et al., (1994). studied the effectiveness of lambdacyhalothrin, deltamethrin and DDT in house spraying for malaria control in Myanmar. Three villages were separately sprayed with Icon (10 WP) at 30 mg/m^2, deltamethrin at 50 mg/m^2 (K-othrine 2.5%) and DDT at 2 gr/m^2 (75%). Bioassay mortality tests showed that Icon and deltamethrin have residual activity for about 8 months, whereas DDT efficacy was for only 6 months. Prasittisuk and her co worker (1992) compared the residual activity of pirimiphos- methyl at 1 gr/m^2, lambdacyhalothrin at 30 mg/m^2 and DDT at 2 gr/m^2 in different villages in Thailand. Bioassay mortality tests against *An.dirud*, indicated that pirmiphos-methyl, Icon and DDT have a residual activity for bout, 3, 5 and 6 months on different surfaces respectively. The results of bioassay test with Icon in central Java were somehow resemble to our results in south of Iran. At 30 mg a.i./m^2 in central Java, on wooden surfaces, Icon had a residual activity for about 15 and 21 weeks in the first and second cycle of spraying, respectively , whereas in south of Iran the efficacy was lasted for 105 days/or 15 weeks. Surprisingly in Myanmar the result of bioassay tests were far from our results, i.e. Icon at 25 mg/m^2 showed a residual activity for about 8 months. The dissimilarity between the two studies might be as the result of differences between the climate conditions of the areas and also susceptibility level of the anophelinae mosquitos used in the trials.

The residual activity and cost effectiveness of lambdacyhalothrin has been compared with DDT, one of the most popular, low cost and long lasting insecticide. Curtis (1994) reviewed the possibility of substitution of new pyrethrid insecticides versus DDT in a malaria vector control. It was estimated that application of lambdacyhalothrin at 25 mg a.i./m^2 in the form of Icon 10% WP, can be cost competitive with DDT 75% WP for protection of a given population for a given time. Apart form cost estimation, entomological study by sharp et al. (cited in Curtis, 1994) of house spraying with DDT and lambdacyhalothrin against *An.arabiensis* showed that both DDT and lambdacyhalothrin are irritant to adults, but the number of mosquito exited alive from DDT sprayed houses were far fewer than the lambdacyhalothrin sprayed houses. It was suggested that the poor performance of DDT was as the result of well known excite-repellency of DDT.

Curtis in his review concluded that in case of availability of alternative insecticides, lack of any cross-resistance between the two insecticides and price competitiveness, DDT should no longer be recommended for malaria vector control.

In south of Iran after appearance of DDTresistance in *An.stephensi* in 1956, application of DDT has been restricted to only south west of Iran (15% of total malarious area), to control DDT susceptible species (Ministry of Health and Medical education , 1993). Regarding to later review, it is worth to switch to the novel pyrethroids as an alternative to DDT in south west of Iran.

In our study, bio-assay mortality test in south of Iran indicated that Icon at 50 mg a.i./m^2 has a residual activity for more than 4 months. Becuase of long season of malaria transmission in south of Iran, Icon (10 WP) at 50 mg/m^2. could be a candidate dosage for continuation study in village scale trial in south of Iran.

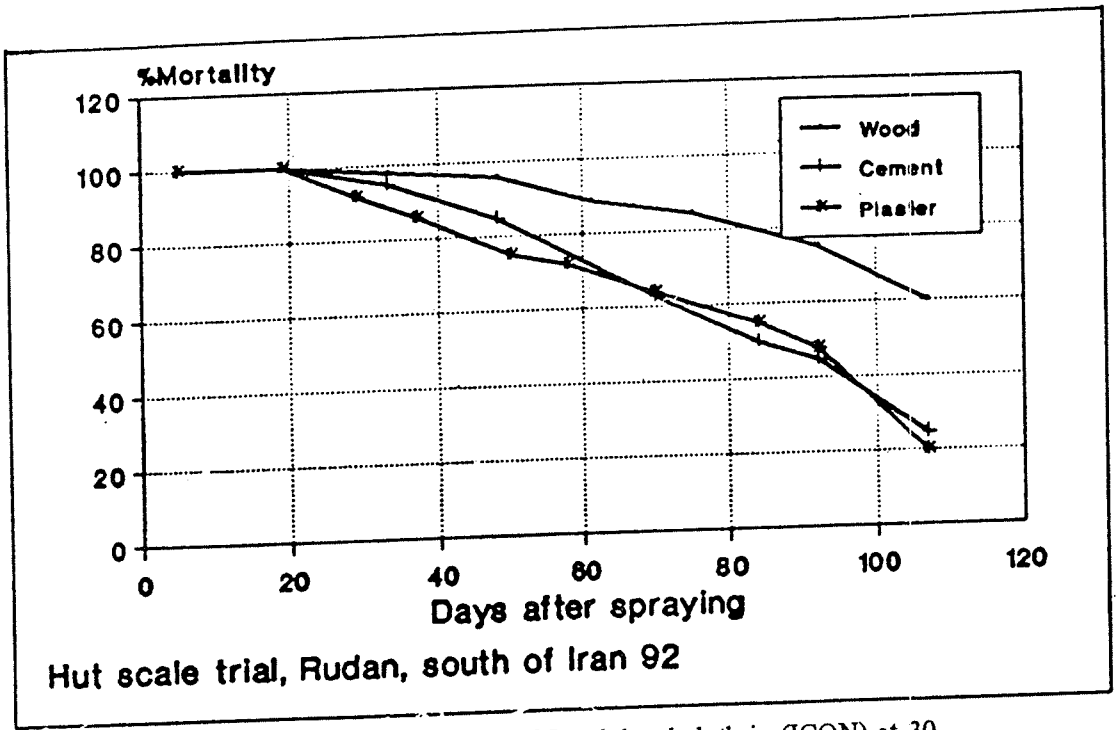

Fig 1- Bio-assay tests for contact efficay of Lambdacyhalothrin (ICON) at 30 mg/m^2 on different surfaces in south of Iran.

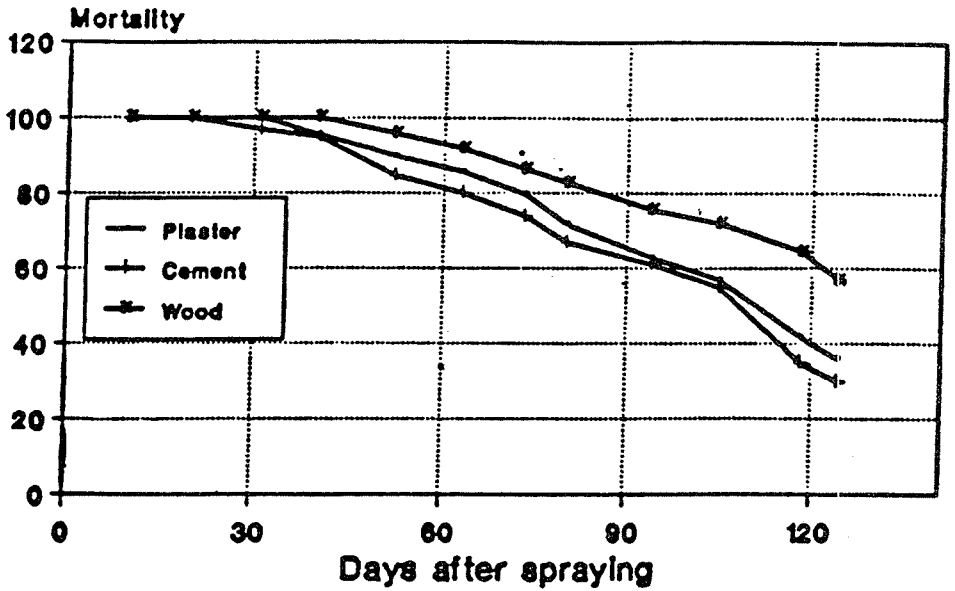

Fig 2- Bio-assay tests for contact efficacy of Lambdacyhalothrin (ICON) at 40 a.i. mg/m^2 on different surfaces in south of Iran.

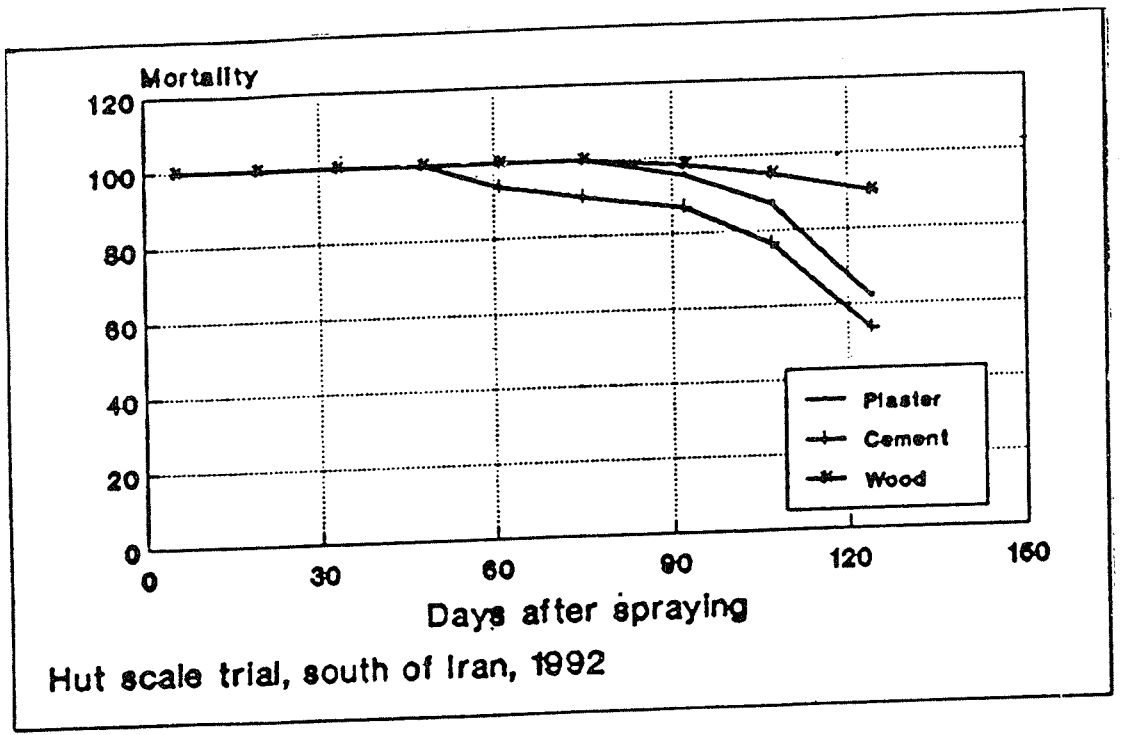

Fig 3- Bio-assay test for contact efficacy of Lambdacyhalothrin (ICON) at 50 a.i. mg/m^2 on different surfaces in south of Iran.

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