

THE SIGNIFICANCE OF EXCITO-REPELLENCY PHENOMENON IN CHEMICAL CONTROL OF MALARIA VECTORS

¹H. ALIPOUR, ²H. LADONNI AND ²M.R. ABAI

¹Dashtestan Health Center, Bushehr University of Medical Sciences

²Department of Medical Entomology, School of Public Health, Tehran University of Medical Sciences

Abstract With respect to the technical, executive and ecological problems involved in residual spraying and along with changes occurred in Roll Back Malaria (RBM) Plan in malaria control, in present time, the strategy of using pyrethroid impregnated bed-nets has attracted the attention of the experts of WHO and agreement of most countries as being a simple and low cost method with the characteristics of having public participation. Also, the ability to integrate in the primary health care (PHC) systems. To study the possibility of laboratory examination of excito-repellency phenomena this research has made major changes in the primary ER-test boxes as they had been presented by different researches and a number of methods and techniques are innovated and used for standardization and sensitization of this system for the evaluation of the mosquito's reaction against the pyrethroid impregnated nets.

For the first time, the standard design of excito-repellency (ER) test box was made of aluminum measuring 30 x 30 x 30 centimeter, which this compartment used as exposure chamber of mosquitoes. At the midpoint of one side of ER-box, a frame measuring 10 x 10 centimeter was devised and an exit trap measuring 10 x 10 x 20 centimeter with adjustable opening was conjoined using iron wire. The whole surface of ER-box was covered with polyester net. The insecticide treated nets are placed on holder containing the restrained guinea pig and thus allowed the lab-bred mosquitoes, which already released inside ER-box, to feed on animal freely.

This research examines the reaction of *An. stephensi* (IND-ST) against the excito-repellency efforts of impregnated nets three types of insecticides, namely Cyfluthrin EW5, lambda-cyhalothrin SC 25 and deltamethrin SC25 by using the new methods of ER-test boxes in laboratory. Also, the indices concerning the ratio of blood feeding rate, knock-down rate, entry index, recovery rate, survival rate and mortality rate are calculated separately for three different concentrations of the three insecticides named above, as well as two exposure time and types of exit trap. To study the significant differences of the excito-repellency test variables, the one-way ANOVA variance has been applied and to determine which group has a significant difference with others, the least significant difference (LSD) test is used.

The results of study on blood feeding ratio of *An. stephensi* carried out by using the impregnated nets showed that despite the full physiological preparation of the released mosquitoes and their trend to blood feeding in exposure chamber and despite the accessibility of the released mosquitoes to the animal bait (guinea pigs) which were kept inside the holder, there was a significant difference between the treatment and control (net without insecticide) cages ($P < 0.05$). The deterrence effects of the insecticides used in nets were studied as well and it was revealed that the mosquitoes were not able to sit on the impregnated nets nor were they able to have blood feeding from the host. They were witnessed to show excited flights or rest in the farthest distance possible away from the nets. The results showed that as the dose of insecticides increased, the trend to rest long in mosquitoes decreased and the mosquito tended to leave the exposure chamber through exit traps. A comparison between the three types of insecticides in blood feeding showed that this ratio was maximum in lambda-cyhalothrin and minimum in deltamethrin. Generally, the average of blood feeding rate in high concentrations was less than in the low concentrations.

The average entry index in trap was examined in exposure with the polyester impregnated nets by the three types of mentioned insecticides. The results of changes in this index among different insecticides showed the least exit entry for those nets impregnated with deltamethrin, and the highest rate was shown against cyfluthrin. This ratio has an obvious correlation with the property of the fast knockdown properties of the insecticides. The average of entry to exit trap revealed significant differences in any concentrations of the mentioned insecticides ($P < 0.05$). Comparing the relation of the ratio of entry index to exit trap and other exit traps with 10 x 10 and 6 x 5 cm and 30 and 60 minutes time showed significant differences in 100 and 50 mg per square meter concentration for cyfluthrin and deltamethrin insecticides; respectively. However, in other concentrations, there was no significant difference between the two insecticides and also, no significant difference was observed in terms of entry exit among the three concentrations of deltamethrin insecticides on impregnated bed nets. The ratio of those knock-down mosquitoes which survived after 24 hours maintenance and recovery rate were also among the indices subject of examination. The high value of this index for any insecticide served as a negative score in the evaluation of the concerned material in the impregnated bed nets plan. In this research, cyfluthrin showed the highest recovery rate and deltamethrin showed the least value. Also, a significant difference was seen between the concentrations as recommended for deltamethrin in comparison with cyfluthrin and lambdacyhalothrin. Another index, which was noted in excito-repellency effect, was the survival rate and comparing them with the rate of the mosquitoes, which survived despite being in contact with the impregnated net during the tests. This index means a population of mosquitoes, which kept away from any contact with impregnated nets and had rest or excited flights in a corner of contact chamber and/or have flew through the exit trap. This index was examined for *An. stephensi* (IND-ST) that had contacts with the nets impregnated with three concentrations of cyfluthrin with 30 and 60 minutes exposure time; however, no significant difference was observed, but there was a significant difference between deltamethrin and lambdacyhalothrin in 12.5 and 50 mg concentrations per square meter ($p < 0.05$). Despite this, there was no significant difference in other concentrations of the two types of insecticides.

The excito-repellency phenomenon occurred in the vector population following the application of definite insecticides. This phenomenon has different impacts on malaria transmission. The excito-repellency may lead to secondary exophilicity at vector population and therefore failure in control program. In these conditions, the mosquitoes leave the sprayed houses to either unsprayed or outdoor shelters before picking up the lethal dose. The importance of this phenomenon is well defined in relation to resting habits of local people in the south part of Iran where they sleep outside in warm seasons.