

Biochemical and Molecular Resistance Mechanisms to DDT and Some Pyrethroid Insecticides in vector of West Nile virus, *Culex pipiens*

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Abstract

Culex pipiens complex act as an important vectors of several vector-borne diseases such as filariasis, West Nile virus, Japanese encephalitis and bird malaria. This study was designed in order to clarify the molecular and biochemical resistance mechanisms in *Cx. pipiens* to DDT and some pyrethroid insecticides from Tehran, capital of Iran. Profile activities of α - and β -esterases, Mixed Function Oxidase (MFO), Glutathione-S Transferase (GST), were tested for *Cx. pipiens* strain with resistance ratio of 85.75 to Lambda-cyhalothrin and also about DDT resistant strain in comparison with Lab strain. In the present research a molecular study also performed on both lambda-cyhalothrin and DDT. Resistant strains for detection of the mutation in the sodium channel gene which is associated with *kdr* insecticide resistance to pyrethroid insecticides and DDT. Finding showed that there are significant difference ($p < 0.05$) between the mean activity of α - , β -esterases and (MFO), in both lambda-cyhalothrin and DDT resistant strain in comparison with Lab-Strain, but there are no significant difference ($p > 0.05$) about (GST) in the both strain in comparison with Lab-Strain. Molecular study for detection of L1014F or L1014S mutation in sodium channel gene showed lack of the mutation responsible for insecticide resistance to pyrethroid and DDT. This study showed that the resistance to insecticides in the *Cx pipiens* is enzymatic, but not targets site insensitivity of sodium channel gene are responsible for pyrethroid and DDT resistance. Findings of this research could provide a clue for logical operations of future chemical control program

Introduction

Culex pipiens complex is a worldwide species and among its members, *Cx. pipiens pipiens* and *Cx. quinquefasciatus* are two more important vectors of several vector-borne diseases regarding to different group of pathogens which causing filariasis, West Nile virus, Japanese encephalitis and bird malaria [1- 4] . *Culex* Genus habitat 5mainly is sewage system of cities and due to this life style resistance to the most group of insecticides in this species it is not excluded [5- 8] . Based on finding of many studies around the world as evaluating resistance status of *Cx.pipiens* to insecticides, result have been indicated that this species has multiple insecticide resistances or at least resistance to one group of insecticides , moreover during recent years resistance to pyrethroids insecticides and DDT in *Cx.pipiens* complex is spreading around the world [9-11]. According to previous studies in Tehran related to evaluation of susceptibility and irritability level to insecticides which performed on *Cx. pipiens* complex ,indicated that resistance ratio in *Cx. pipiens* to different groups of insecticides increased and also it can be stated that about DDT this species is quite resistant . In the most species of mosquitoes, resistance to different groups of insecticides caused by two main mechanisms which known as metabolic resistance due to enzymatic detoxification by enzymes involved in resistance including cytochrome P450 oxidases, esterases and Glutathione-S-Transferases(GST) and also it seems that resistance to pyrethroid compounds caused by increasing level of oxidases and second reason is target site insensitivity due to substitution in nucleotides which about pyrethroid compounds and DDT. Resistance cases this mutation lead to translating leucine to phenylalanine or leucine to Serine in the S6 hydrophobic segment of domain II in the sodium channel gene that known as Knock down resistance (*kdr*) mutation . In some species from *Culex* genus the same *kdr* mutation is present at position 1014 which known as L1014F(TTA to TTT) or L1014S (TTA To TCA) in pyrethroid-resistant cases .The present study was performed for clarifying the molecular and biochemical resistance mechanisms in *Cx. pipiens* to DDT and some pyrethroid insecticides.

Materials and Methods

This study was performed in Tehran city (35° 41' 46" N, 51° 25' 23" E), Tehran Province, the capital of Iran

Mosquito strains

The wild larval stage strains of *Cx. pipiens* collected from collection site in the study area and for more investigation all wild -caught larval were reared in the insectary of School of Public Health, Tehran University of Medical Sciences under the standard condition. Moreover as comparison a laboratory strain of *Cx. pipiens* were used.