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GST DETOXIFYING ENZYMES AND PYRETHROID INSECTICIDE RESISTANCE IN THE RED PALM WEEVIL IN THE UAE

by

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Date & Venue

01:30 PM
Tuseday, 11 June 2019
Room 132, F3 Building

Abstract

The red palm weevil, *Rhynchophorus ferrugineus*(Coleoptera: Curculionidae) is the most important date palm tree insect pest in the United Arab Emirates and the world. It causes severe damage to the most important tree in the UAE and the Gulf Cooperation Council (GCC). This insect entered the UAE in 1986 and since then it has been the most economic pest in the country. Larva is the damaging stage, which is concealed inside the tree trunk; a factor makes early detection very difficult. Infested trees become weaker over time and easily broken by wind. Several chemical insecticides are used to control the red palm weevil; however, the pest is still causing damage and spreading to new areas. Thus, insecticide resistance development in the insect population needs to be evaluated. The main objectives of this thesis are : (1) Screening red palm weevil population for the activity of GST detoxifying enzyme , which play role in insecticide metabolic resistance, (2) Evaluating the gene expression of different classes of red palm weevil GST enzymes in the UAE (3) Genotyping red palm weevil for the presence of mutations conferring pyrethroid insecticide resistance. The project screened, for the first time in the UAE, for insecticide resistance genes in the red palm weevil population. To measure glutathione transferase activity 1-chloro-2,4-dinitroben-zene (CDNB) was used as substrate. Protein concentrations were determined using the Bradford method. GST specific activity is affected by tissues (muscle and brain), developmental stages and gender. GST specific activity was higher in the brain than in muscles, and the adult stage had the highest GST specific activity. In addition, there was no significant difference between the male and female. Total RNA was extracted using RNeasy Mini kit and quantitative real time polymerase chain reaction (RT-qPCR) were performed. Different classes of the GST genes were expressed differently in the different tissues. Delta and epsilon classes of GST were highly expressed in the gut comparing to other GSTs classes. Reverse transcription polymerase chain reaction (RT-PCR) amplified the knockdown resistance (*kdr*) gene mutation. All samples were susceptible to pyrethroid insecticide. The study provided, for the first time in the world, the sequences of six GST genes of the red palm weevil. In addition, it provided the sequence of the sodium channel gene and a primer pair amplifying the regions of nine mutations including the *kdr* and super-*kdr*. This study is performed for the first time in the UAE on insecticide resistance genes in the red palm weevil population. In addition, this study amplified gene expression of GSTs classes in RPW in the UAE for the first time. A further investigation is needed to study GST induction in RPW, genotyping of different classes of GSTs and a larger scale study in detecting the knockdown resistance gene mutations in the other emirates of the UAE.

Keywords: *Rhynchophorus ferrugineus,* insecticide resistance, GST specific activity, RT-PCR, quantitative polymerase chain reaction, gene expression, Knockdown resistance (*kdr*).