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Proteomics and bioinformatics of the insecticide DDT target

Hassan M. Younis
Alexandria University, Egypt

The insecticide, 1, 1-bis (p-chlorophenyl)-2, 2, 2-trichloroethane (DDT) has been used for control of malaria mosquitoes and other insect vectors of human diseases since 1945. Its use poses an environmental dilemma and efforts to replace it have been hampered by lack of information about its molecular target. The study presented here is the first to identify such a target as the insect ATP synthase that provides new clues for specific insecticidal design. The ATPase activity of the enzyme preparations from *Apis mellifera* was inhibited up to 97% by 1.5 μM DDT, whereas the enzyme from bovine was insensitive to DDT. The inhibition of the insect enzyme activity was associated with the presence of a 23 kDa protein band of the enzyme that existed in the preparations from *Apis mellifera* (DDT-susceptible) but was absent from the preparations of the enzyme from DDT-insensitive sources. Evidence provided by using 2D gels and mass spectrometry peptide analysis showed that this protein band is a mixture of subunit "d" and oligomycin sensitivity conferral protein (OSCP) of the *Apis mellifera* ATP synthase, and that no obvious counterpart of this protein mixture is present in the DDT-insensitive bovine enzyme. The OSCP of the bee's ATP synthase contained 207 amino acids compared to 190 in bovine, which is insensitive to DDT, and the identities were only 47%. Subunit "d" of the bees had no counterpart in the bovine. Both subunits, the OSCP and subunit "d", are components of the peripheral stalk (the stator) of the ATP synthase. Interaction of DDT with OSCP and/or subunit "d" would interrupt such a structure, freeze the mechanical rotation of the enzyme and block synthesis of ATP.

Identification of the DDT's molecular target will lead the way to new target based insecticides aimed to protect plant, combat malaria and other insect transmitted diseases.

Biography

Hassan M. Younis has completed his Ph.D. from Alexandria University and postdoctoral studies from Cornell University, Section of Biochemistry, Molecular and Cell Biology and from University of Illinois at Urbana, School of Life Sciences and School of Chemical Sciences. A coordinator of Biochemistry and Molecular Biology at the University of Alexandria Research center (UNARC), and Professor of Pesticide Chemistry and Technology, Faculty of Agr., He has published more than 60 papers and a contributor to main Biochemical Journals i.e., JBC, Biochemistry, BBA, BBRC, Biotechnol Appl Biochem, J Bioenerg & Biomembr and others. He is the founder of the Egyptian Society for Promotion of Scientific Research and founder of the Egyptian Science Magazine (ESM), ISSN: 1687-3815.

hassanyounis@gmail.com