Cadherin-like receptor from the European corn borer (*Ostrinia Nubilalis*) for *Bacillus thuringiensis* cry1A toxins

(Recived: 15.10.2002;Accepted: 23.03.2003)

Salah A. Mostafa[*], W.S.A. Maaty[*], M.A. Madkour[*] and L.A. Bulla, Jr[**]
**Department of Molecular and Cell Biology, The University of Texas at Dallas, Richardson, TX[2].
*Agricultural Genetic Engineering Research Institute, 9 Gamaa St. Giza,

ABSTRACT

Bacillus thuringiensis Cry1A toxins are lethal to the corn pest European corn borer (Ostrinia nubilalis) larvae. Cry1Aa, Cry1Ab and Cry1Ac bind to a protein of ~205-kDa in the brush border membrane vesicles. In addition, Cry1Ab binds to proteins of ~ 150 and 170-kDa and Cry1Ac binds to proteins of ~120 kDa. A competition ligand blot using unlabeled Cry1Ab to compete with ^{125}I-Cry1Ab shows that binding to the 150, 170 and 205-kDa proteins is compateted away by Cry1Ab. Furthermore, toxin-receptor dissociation constant K_d shows that the binding occurs with high affinity (K_d ~ 1.2 nM). These results suggest that Cry1Aa, Cry1Ab and Cry1Ac share a 205-kDa common membrane binding protein and they bind specifically with high affinity. The Southern blot and polymerase chain reaction analysis show that O. nubilalis contains a homologue to the 210-kDa Manduca Sexta BT-R$_1$ cadherin-like receptor which mediates toxicity for Cry1A toxins. Consequently, these results suggest that the 205-kDa protein band is a cadherin-like receptor homologous to the 210-kDa tobacco horn worm receptor. Therefore, it is more likely that the 205-kDa receptor is mediating toxicity to O. nubilalis but not the 120, 150 or 170-kDa proteins.

Keywords: *Cadherin/ Ostrinia nubilalis /Bacillus thuringiensis/Cry toxin*

* These authors contributed equally to this work § Corresponding author

INTRODUCTION

Microbial *Bacillus thuringiensis* (BT) based products have been used commercially for almost 40 years by growers, to control selected insect pests (Baum *et al.*, 1999). *Bacillus thuringiensis* is a gram-positive, spore-forming bacterium that forms a parasporal crystal which contains insecticidal toxins (Bulla *et al.*, 1980; Höfte and Whiteley, 1989). This observation led to the development of bioinsecticides that utilize *B. thuringiensis* for the control of many insect Species in the order Lepidoptera, Diptera, Coleoptera, Hymenoptera, Orthoptera and Mallophaga and against nematodes, mites and protozoa (Schnepf *et al.*, 1998). The toxin binds readily to specific receptors on the apical brush border of the midgut microvillae (BBMV) of susceptible insects (Hofmann *et al.*, 1988a;b). One of the most destructive pests in the world is the European corn borer. It causes severe damage to corn in Egypt and worldwide. We were interested to study the molecular mechanism by which the Bt toxins can control this insect. Our laboratories