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2020年 03 月 25 日
Year Month Day

学位 (博士) 論文要旨
(Doctoral thesis abstract)

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| 論文提出者 Ph.D. Candidate | 生物システム応用科学府 食料エネルギーシステム科学 専攻 博士後期課程 一貫制博士課程 専修/グループ(Department Course) 平成 27 年度入学(Your Entrance Fiscal Year) 氏名 李 校一 ㊟ (Your Name(Family, First) and Seal) | | | | |
| 主指導教員 氏名 Chief Advisor's Name | 佐藤 令一 | 副指導教員 氏名 Vice Advisor's Name | | 副指導教員 氏名 Vice Advisor's Name | |
| 論文題目 Title | Identification of BmABCA2 as a Functional Receptor in the Bombyx mori Midgut for Cry2A Toxins. カイコガ中腸ABCトランスポーターA2分子のCry2A毒素受容体としての役割と機能に関する研究 | | | | |
| 論文要旨 (和文要旨(2000字程度)または英文要旨(500words)) ※欧文・和文どちらでもよい。但し、和文の場合は英訳を付すこと。 Write a summary in Japanese (2000 characters) or in English (500words). If the abstract is written in Japanese, needed to translate into English. Cry toxin is a kind of insecticidal proteins which produced by bacterium <i>Bacillus thuringiensis</i> (Bt). It has been used commercially to control insect pest and has highly active to specific insects and important among agriculture and public healthy. Bt toxin was first discovered in the early 1900s, and now it is becoming widely application as biopesticides in organic agriculture and forestry that supplement application of the synthetic chemical pesticide in commercial agriculture. Such as spraying of vast areas of North American forests to control lepidopteran defoliators. They are highly specific to their target and innocuous to other organisms which include all vertebrates, plants and completely biodegradable. It also as the significance genes for transgenic expression to resistant insect pests in plants. The mode of action of difference Cry toxins have been used by different procedures to pore-forming and induce cell death with ionic pores into the membrane of the midgut epithelial cells. The pro-toxin traverse the peritrophic, and binding with the functional receptor in midgut cell. One of the models supports that the Cry toxins crystal during midgut proteases to binding with receptors resulting oligomerization of the toxin forming a pore in lipid rafts that induce osmotic cell lysis. On the other hand, an alternative model triggered activation of protein kinase, which is a signal pathway induce the toxin interaction to kill cells. The mechanism as the most influential approach to be known as Bt toxin. | | | | | |

Nowadays, there are many insecticidal crystal protein genes were cloned from Bt. However, some toxins exerting intense evolutionary pressure were the most susceptible pests have been expressing in transgenic crops. It may now as the largest cause of death for some insect pests, but represented a potent selective force for resistance. The selection has caused the rapid evolution of Bt toxin resistance in a few insect species and reduced efficiency of insect pest control. Thus, to explore novel functional receptors of Bt toxin are integrant for growing insecticidal crystal proteins act on delaying resistant.

The Cry2A toxins are potential to be susceptible crystal protein to insect for extension commercial pest insecticide. The ABCA2 has been first suggested that linked to Cry2Ab resistance in *Helicoverpa armigera*. It was further confirmed by generating ABCA2 knock-out strain with CRISPR/Cas9 mutagenesis, which showed highly resistant in *H.armigera* and *Trichoplusia ni*. However, it still unknowns how the ABCA2 involved in the pathway of toxicity in Cry2A toxins. Thus, in this study, we tried with two methods, genome editing ABCA2 in *Bombyx mori* (BmABCA2) with Transcription Activator-like Effector - Nucleases (TALENs) and transient BmABCA2 gene expression in HEK293T cells. The Bio-assay of the BmABCA2 truncated strain by TALENs showed high level of resistance to the Cry2A toxins, indicating that BmABCA2 play a crucial role in the mechanism of action of Cry2A toxins. On the other hand, HEK293T cell expressed BmABCA2 was showed swelling neurosis with Cry2Ab toxin, which indicated that BmABCA2 can function as a functional receptor of Cry2A toxins.

Reference

1. Tay, W.T., et al., *Insect resistance to Bacillus thuringiensis toxin Cry2Ab is conferred by mutations in an ABC transporter subfamily A protein*. PLoS genetics, 2015. **11**(11): p. e1005534.
2. Wang, J., et al., *CRISPR/Cas9 mediated genome editing of Helicoverpa armigera with mutations of an ABC transporter gene HaABCA2 confers resistance to Bacillus thuringiensis Cry2A toxins*. Insect biochemistry and molecular biology, 2017. **87**: p. 147-153.
3. Yang, X., et al., *Mutation of ABC transporter ABCA2 confers resistance to Bt toxin Cry2Ab in Trichoplusia ni*. Insect biochemistry and molecular biology, 2019. **112**: p. 103209.

(英訳) ※和文要旨の場合(300 words)

If the abstract is written in Japanese, needed to translate into English.(300 words)