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Effect on the biological function of allyl isothiocyanate against COX core subunit of Sitophilus zeamais

Hua Wu

College of Plant Protection,
Northwest A&F University, Yangling,
China

Abstract

Allyl isothiocyanate (AITC) is registered in China as a biological fumigant to control root knot nematodes, which also have a potent insecticidal activity to all the stored-grain pests, especially for controlling Sitophilus zeamais Motschulsky. Our previous study showed that mitochondrial complex IV (COX) was the primary target of AITC in adult S. zeamais and the order of AITC inhibitory activity on the core subunit was COXI> COXIII> COXII. To further study the effect on the biological function of AITC against COX core subunit of S. zeamais, we employed RNA interference (RNAi) by using double-stranded RNA (dsRNA) to knockdown three core subunits of cytochrome c oxidase (COX)-I, -II and -III in 18-day-old larvae prior to their exposure to AITC to detect susceptibility changes. The sensitivities of dsRNACOX I and II injection treatments significantly increased at 72 h after absorption while the mortality reached up to 85.56% and 67.78%, respectively. DsRNACOX-I and dsRNACOX-II injection showed the same subcellular structural characteristics showing vacuolization and vague mitochondrial cristae and decrease of COX activity during AITC fumigation treatment, suggesting the potential of COX-I and COX-II as the targets of AITC.The silencing was efficient and specific, the mortality reached 75.55%, 71.88% and 82.22% after injection of dsRNACOX I, II and III, respectively, leading to S. zeamais larvae turning from milky white to dark brown in the thorax and whole body and eventually death. Overall, COX I and II might be potential targets of AITC and dsRNACOX I, II and III have the potential to be developed into nucleic acid pesticides and are worth pursuing for improving AITC fumigation activity in pest control.

Biography:

Dr. Hua Wu Associate professor and PhD Student Supervisor of Pesticide Toxicology, College of Plant Protection, Northwest A&F University, China.

Research Interests: Pesticide chemistry and pesticide toxicology, including drug discovery and development, bioactive secondary metabolites, insecticidal, antibacterial and antifungal activity. He is expertized in the techniques of HPLC, GC-MS, MS, RNAi and ect. He published his research results in more than 30 peer-reviewed articles.

Speaker Publications:

1. "Effect of allyl isothiocyanate on ultra-structure and the activities of four enzymes in adult Sitophilus zeamais"

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