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Use of RNAi mediated gene knockdown in insects for pest control

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ABSTRACT

RNA interference (RNAi) is a gene silencing mechanism at the cellular level triggered by double-stranded RNA (dsRNA) and is likely to be the new approach underlying the next generation of insect-resistant transgenic plants. In some studies, successful delivery of dsRNA molecules to insects by ingestion resulted in the expected essential gene target silencing , which led to death or affected the viability of the target insect, resulting in control of the pest. The RNAi pathway in the cell is initiated by an RNase III enzyme called Dicer, which processes dsRNAs into short (21-25 nucleotide) small interfering RNAs (siRNAs).These siRNAs become incorporated into a protein complex known as the RNA induced silencing complex (RISC). Once formed, the RISC is guided to a specific mRNA that is complementary to one of the strands of the siRNA causing its degradation. Argonaute protein is the major component in the RISC and mediates target recognition and cleavage. Therefore, the target mRNAs that are either cleaved or blocked for translation in posttranscriptional silencing, or inducing histone modifications when involved in transcriptional silencing response. However, the RNAi systemic spreading mechanism is not conserved across organisms, and its elucidation is an essential step in developing an efficient method to control agricultural pests by RNAi technology.Systemic RNAi occurs in some insects, but not others. The ingested dsRNAs can act as species-specific insecticides when fed to D. melanogaster, Tribolium castaneum, Acyrthosiphon pisum, and Manduca sexta when each insect was fed species-specific dsRNAs targeting vATPase genes. The dsRNAs had to be encapsulated into liposomes to ensure uptake in the D. melanogaster diet, but the other species tested did not need this treatment.

Keywords: ds RNA, gene silencing, pest control, RNA interference.