Year 5: Developing a Novel RNAi Based Biopesticide Optimized via Bioenhancers to Target the miRNA Bantam in Spodoptera frugiperda for Environmentally-Friendly, Cost-Effective Improved Pest Management

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The fall armyworm is a destructive pest affecting more than 80 plant species, most notably maize, resulting in an estimated $9.4 billion in annual agricultural losses. As the global population nears 9 billion by 2050, the pressure on food security continues to rise. While traditional chemical pesticides currently protect crop yields, their continued use has triggered widespread pest resistance and significant ecological and health concerns, requiring a shift toward innovative alternatives. This research focused on the development of a targeted biopesticide using bioenhancers to optimize RNA interference delivery. The study evaluated these methods across both laboratory and field environments, specifically targeting fall armyworm populations. Key performance indicators included physical metrics, such as pupae weight, color, variations, and physical deformities; survival rates, such as overall mortality levels; statistical validation, including One-Way ANOVA (with Tukey HSD) and Mann-Whitney U tests which confirmed significant differences ($p<0.05$) between the treated and control groups; and gene suppression using Quantitative PCR (qPCR) to measure the specific reduction of target gene expression. Data suggests that the use of bioenhancers can increase absorption rates by as much as 200%. By combining RNAi's ability for specific pest targeting at various knockout rates with these bioenhancers, farmers can significantly reduce the volume of dsRNA required, which lowers costs and maximizes crop health. Using bioenhanced double stranded RNA provides a highly specific, eco-friendly, and cost-effective alternative to conventional chemical pesticides, representing a viable path forward for managing pests and weeds while ensuring sustainable increases in global food production.

Awards Won:

Second Award of $2,400