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## Essential Oils and Their Role in Sustainable Cotton Pest Management

Cotton, referred to as “White-Gold,” is a significant commercial crop in India, accounting for approximately 25% of the world’s cotton production. It thrives in hot, sunny, and rain-fed environments. The cotton plant’s parts, such as the soft lint and cottonseed, are extensively utilized in the textile industry and as animal feed. India is the second-largest producer of cotton globally. The cultivation of cotton directly supports 6 million farmers and indirectly provides employment to 40-50 million people in related sectors. However, the crop is vulnerable to various pests, with the Pink Bollworm (*Pectinophora gossypiella*) being the most notable. The Pink Bollworm threatens cotton crops worldwide by damaging the fibers and reducing the overall yield and quality of fiber. Previous studies have explored the use of pheromones as an eco-friendly method to control these infestations. These pheromones interfere with mating and hinder population growth, providing a sustainable control that reduces reliance on conventional insecticides. However, the effectiveness of these studies has been limited, indicating the need to explore alternative eco-friendly strategies. The proposed research will investigate the composition, combinations, and ratios of various essential oils to determine their effectiveness against crop-infecting insects as next-generation pesticides. These oils, which are complex mixtures of bioactive compounds derived from aromatic and other plant species, were selected after a thorough literature review. It has been ensured that their use complies with the guidelines set by the Environmental Protection Agency (EPA). A combination of essential oils, and their effect on the growth and repellent activity of selected insects, will help us to develop an effective solution against major pests affecting cotton crop. The findings of this study will contribute to the development of innovative pest management strategies for sustainable agriculture, marking a significant stride towards eco-friendly farming practices.

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