Effectiveness of Nanoparticle-Based Treatments in Controlling *Oligonychus afrasiaticus* (McGregor) (Acari Tetranchidae) Infestation in Date Palm Trees

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Abstract. Date palm mite *Oligonychus afrasiaticus* (McGregor) (Acari: Tetranychidae) infestations pose a significant threat to date palm plantations, leading to reduced crop yield and economic losses. Nanoparticle-based strategies have emerged as a promising approach for controlling mite populations due to their unique physicochemical properties and environmentally friendly nature. In this study, we investigated the impact of three different nanoparticle types, namely silver, silica, and sulphur, on the mortality rate of date palm mites at different life stages (larvae, nymphs, and adults). The experiments were conducted at various concentrations and time intervals to assess the efficacy of the treatments. The results revealed significant variations in the effectiveness of the nanoparticle types, with nanosulphur demonstrating the highest mortality rate (45.576%) followed by silica (38.587%) and silver nanoparticles (34.957%). Furthermore, the results indicated that adult mites were more susceptible to nanoparticle-induced mortality compared to larvae and nymphs. The concentration-dependent response showed that higher nanoparticle concentrations led to greater mite mortality, with the highest concentration (500 ppm) resulting in an impressive mortality rate of 55.163%. Time-dependent studies demonstrated a progressive increase in mortality rates over 48 hours, reaching 46.017% at the endpoint. These findings provide valuable insights into the differential susceptibility of date palm mite life stages to nanoparticle treatments and underscore the importance of considering both nanoparticle type and concentration for effective control of date palm mites. This knowledge contributes to the development of targeted nanoparticle-based strategies for mitigating date palm mite infestations and preserving the productivity of date palm plantations. This study contributes valuable insights into the potential use of nanoparticle-based treatments for managing *O. afrasiaticus* infestations in date palm trees.

Keywords. Oligonychus afrasiaticus, Dust mite, Date palm, Nanoparticles, Nanosilver, nanosilica, Nanosulfur, Mortality rate, Concentration, Time intervals.

1. Introduction

The date palm (*Phoenix dactylifera* L.) is an important crop in desert regions and is known for its historical importance in preserving human life and cultural traditions [1]. Arabic countries, especially in South Asia and Africa, are dominant in date palm cultivation. They own 70% of the world's 120 million date palm trees and account for 67% of world date production [2,3]. However, there are many