



Supplementary Materials

The Effect of Silicon Dioxide Nanoparticles Combined with Entomopathogenic Bacteria or Fungus on the Survival of Colorado Potato Beetle and Cabbage Beetles

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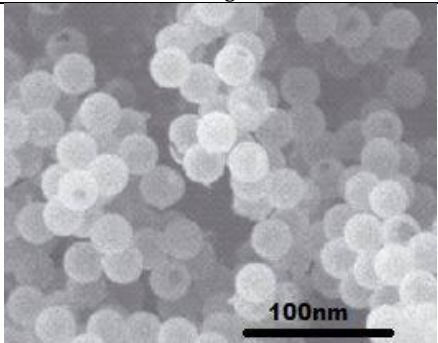
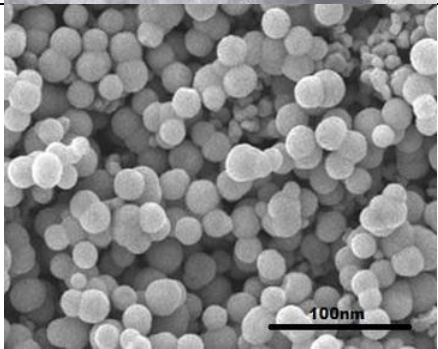
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Table S1. Properties of nanoparticles used in this study.

Product №	Modification	Product Properties	Images	Link
6851HN	Modified with amino group	Nanopowder, SiO ₂ , 99.8%, 10-20 nm Loss on drying (%) (105 °C, 2h): <3 Loss on ignition (%) (950 °C, 2h): <10 SiO ₂ content (dry basis) (%): >85 SiO ₂ content (950 °C, 2h) (%): >99.8 Carbon content (%): >0.3 Surface area (m ² /g): 90-130 Bulk density (g/ml): 0.15		*3 SiO ₂
6811DL	Treated with silane coupling agents (SiO ₂ , 99%,)	Nanopowder, SiO ₂ , 99%, 10-20nm SiO ₂ Nanopowder SSA: >400 m ² /g Silane content: 1~2wt%		*2 SiO ₂
6852HN	Modified with epoxy group	Nanopowder, SiO ₂ , 99.8%, 10-20 nm Loss on drying (%) (105 °C, 2h): <3 Loss on ignition (%) (950 °C, 2h): <12 SiO ₂ content (dry basis) (%): >85 SiO ₂ content (950 °C, 2h) (%): >99.8 Carbon content (%): >0.3 Surface area (m ² /g): 90-130 Bulk density (g/ml): 0.15	no picture	*1 SiO ₂

Images were provided by supplier: *3 SiO₂ - <https://ssnano.com/inc/sdetail/silicon-oxide-nanoparticles--nanopowder-modified-with-amino-group/363>; *2 SiO₂ - https://ssnano.com/inc/sdetail/silicon_oxide_nanoparticles_99_0_/209; *1 SiO₂ - https://ssnano.com/inc/sdetail/silicon_oxide_nanoparticles/364.

Table S2. Nanoparticle antifungal and antibacterial activity against *Metarhizium robertsii* (Mr) and *Bacillus thuringiensis* (Bt). Data presented as the number of colony-forming units (CFU) per Petri dish, three replicates per treatment; Mean \pm SE, One -way ANOVA with Dunnett post-hoc comparison used for comparison of the nanoparticle effects on bacteria and fungi compared to the control (PBS treatment).

Product	Antibacterial (Bt) CFU; p value	Antifungal (Mr) CFU; p value
PBS (control)	1795 \pm 84.13	2177 \pm 107.4
1 SiO ₂	1926 \pm 18.41 p = 0.3296	2050 \pm 50.33 p = 0.4856
2 SiO ₂	1979 \pm 69.29 p = 0.1325	2120 \pm 70.00 p = 0.8951
3 SiO ₂	1855 \pm 38.75 p = 0.8170	2034 \pm 33.88 p = 0.4021

S.1 Method for nanoparticle antimicrobial activity analysis

The antimicrobial activity of three modifications of silicon dioxide nanoparticles (with epoxy (1 SiO₂), silane (2 SiO₂) and amide (3 SiO₂) groups) was analysed against the fungus *Metarhizium robertsii* (Mr) and the bacterium *Bacillus thuringiensis ssp. morrisoni* var. *thuringiensis* (Bt). Fungus and bacteria (10⁴ in PBS) were incubated with nanoparticles (1 mg per mL) for 4 h at 28 °C, and 250 μ L cultured on plates of Luria-Bertani (LB) medium (for Bt) or Czapek medium (for Mr). CFU of bacteria and fungi were counted at 24 h and at 3 days respectively post cultivation at 28 °C.