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Nanoparticles as novel insecticidal agent for crop protection

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Abstract

High volume uses of conventional pesticides end up contaminating environment with highly toxic pesticide residues. Moreover, worldwide ban on many popular fumigants and increasing insecticide resistance in many insect pests have insisted pest management researchers to find out alternative entomotoxic (insecticidal) agent to protect crops.

As nanocides are expected to lessen the volume of application and reduce the kinetics of development of resistance in pests, we hypothesized that surface functionalized nanoparticles might be a viable alternative to the commercial insecticides. The entomtoxicity of surface functionalized, amorphous nano silica, nano zinc oxide, nano titanium dioxide and nano alumina of different size range was tested against rice weevil *Sitophulus oryzae* and mustard aphid *Lipaphis pseudobrassicae*. *S. oryzae* is an important insect pest damaging stored grains worldwide and *L. pseudobrassicae* causes devastations on oil producing mustard crops. Nano alumina and amorphous nano silica were found to be highly effective against these insect pests causing more that 90% mortality. Though some researchers have shown that nano alumina in ground water inhibits the growth of several plants, nano silica has no adverse effect on plant growth, rather it enhances structural rigidity and strength of plants. Nano zinc oxide and titanium dioxide were not much effective entomotoxic agents. The mode of action study revealed that these nanocides damage insects' protective wax coat on the cuticle, both by sorption and abrasion and cause insect death through desiccation. Both in vitro and in vivo toxicity study showed that nano silica is safe for mammals if applied in physiologically relevant dosage.

This study could lead to open up newer pathways of using nanoparticles for controlling insect pests.

Biography

Nitai Debnath has completed his Ph.D. from Indian Statistical Institute, Kolkata, India in March, 2013. He joined as a senior lecturer of Biotechnology in Amity University Haryana, India in April, 2013. He has published 18 papers in reputed journals.