NanoSide: A Potential New Insecticide for Controlling Hairy Caterpillar in Jute

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Indiscriminate use of synthetic pesticides for higher crop yield has adversely affected the biosphere leading to environmental pollution and harm to non-target organisms. Jute (Corchorus capsularis L.) is a major fibre crop mainly cultivated in South and South-East Asia. Although nanotechnology in pest control is a relatively new field, it offers several benefits due to the scale at which nanoparticles function. In the present study, the efficacy of nanosilica (NanoSide - SiNP) was tested against a polyphagous pest of jute, the hairy caterpillar (Spilosoma obliqua Wlk.). Six working concentrations (10 ppm, 1 ppm, 0.1 ppm, 0.01 ppm, 0.001 ppm, 0.0001 ppm) of SiNP were sprayed on 3rd instar larvae under in vitro conditions. Glasshouse study and residue analysis were conducted to determine biosafety. The molecular mechanism of action was analysed. FESEM revealed the average diameter of SiNP as 20 nm. SiNP spray @ 10 ppm on HC resulted in highest 64.4% body weight reduction and 75.5% mortality after 72 hours. I established that conventional silica and polyvidone (stabilizing factor) have no effect on S. obliqua. The LC50 of SiNP was determined as 0.001 ppm. Molecular mechanisms using in silico approach helped identify miR-1 with highest expression value which controls SRC gene expression. In vivo approach showed that miR-1 shows 100-fold increase and results in apoptosis by expressing SRC to serve as killer tool in treated S. obliqua cell lines only. SiNP residue was absent in treated jute leaf and stem tissues as per fluorescence assay and GCMS assay. The study revealed that NanoSide is an efficient and eco-friendly alternative to toxic pesticides as part of integrated pest management (IPM) strategy.

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