Graphene Oxide-Based Nanoformulations: A Novel Solution To Manage Aedes aegypti

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Aedes aegypti management is a global concern due to the absence of medication and effective vaccines. The pesticide-mediated health hazards and rising insecticide resistance in mosquitoes have aggravated the issues. Graphene Oxide (GO)-based nanoformulations are considered a novel mosquito management strategy. The present investigation evaluated the efficacy of GO-based nanoformulations conjugated with malathion (ML) and endosulphan (EN) against Ae. aegypti. The GO was synthesized by the Hummers' method and was confirmed by UV-visible spectral analysis. The GO-ML and GO-EN binary mixtures (1:1 and 1:2) were assayed for toxic potential against mosquito larvae as per WHO protocol and the dead larvae were scrutinized for morphological deformations/abnormalities. The contact irritancy potential of GO nanoformulations was also evaluated against adult Ae. aegypti. The effect of the formulations on organisms co-inhabiting the larvae was estimated. The UV-visible spectrum of GO showed a narrow and high peak at ~300 nm which refers to an n-p* plasmon peak. The GO-insecticide mixtures augmented the ML and EN toxicity by 80.43% and 6.43-fold, respectively. The GO-ML mixture-exposed larvae showed cuticular deposition of black soot while larvae exposed to GO-EN exhibited disintegrated gut viscera. GO-insecticide combinations increased flights in Ae. aegypti denoting irritant potential. The efficacy of the formulations did not diminish after 8 weeks indicating their durability. Evaluation against non-targets; Daphnia magna and Moina macrocopa showed their safety against them. The effective activity of GO-insecticide nanoformulations along with sustained effects and safety against non-targets recommends developing graphene-based toxicants for mosquito management.

Awards Won:

Third Award of $1,000

YM American Academy: Second Award of $1000