IMPROVING PROPERTIES OF SOME BOTANICAL PRODUCTS USING DIFFERENT NANO-TECHNOLOGICAL METHODS FOR CONTROLLING TWO LEPIDOPTEROUS PESTS

By

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B.Sc.Agric.Sc.(Economic Entomology), Cairo Univ.(1998)

M.Sc.Agric.Sc.(Economic Entomology), Cairo Univ. (2004)

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ABSTRACT

Two plant products, *i.e*. neem (*Azadirachta indica* A. Juss) extract and peppermint (*Mentha pipreta*) oil were selected in this study to evaluate the efficiency of their three different formulations, *i.e*. bulk, nano-emulsion and loaded nano-emulsion against 2nd and 4th instar larvae of two lepidopterous insect pests, *i.e*. the cotton leafworm, *Spodoptera littoralis* (Boisd.) and the black cutworm, *Agrotis ipsilon* (Hufn.). The evaluation process included investigation the efficacy of the prepared nano formulations against the two larval instars of both species and the effect of the same formulations on some biochemical parameters in the treated insects, *i.e*. α-amylase, invertase, trehalase, protease, alkaline phosphatase, phenoloxidae and chitinase. Also, the effects of such formulations on some bionomics were also studied. In addition, the toxic effect of neem nano formulations on albino mice as mammalian model was included in this work.

At the beginning, the characterization of the obtained nano-formulations, *i.e*. nano-emulsion and loaded nano-emulsion using Transmission Electron Microscopy (TEM), UV spectrophotometric examination and Fourier Transforms Infrared (FTIR) showed that the nano-emulsion particles ranged between 20-90nm. The loading capacity percentages exhibited that distilled H_2O was more suitable than ethanol in preparation of nano-emulsion particles. The bioassay study to measure the efficiency of the tested formulations showed that the 2nd instar larvae was always more susceptible than the 4th instar larvae against the tested formulations. For example, LC_{50}s on 2nd instar larvae of *S. littoralis* for peppermint oil were 70.59, 12.23 and 21.72 ppm for bulk peppermint oil, peppermint nano-emulsion and loaded nano-emulsion, respectively. While on 4th instar these values were 80.47, 26.14 and 67.69 ppm, respectively. Toxicity index and relative potency proved that nano-emulsion was more effective than loaded nano-emulsion, while the bulk preparation was the least effective one. Results of enzymatic activities

showed significant inhibition of the tested enzymes except phenoloxidase and some treatment of chitinase in the 2nd instar larvae of the two selected insect pests. Furthermore, effects of adding the three formulations to artificial diet of 2nd instar of the two selected insects showed significant effects of the insect bionomics. Larval durations, percentage mortalities, were increased as well as larval malformations. Also, pupal duration, percentage pupal mortality and pupal malformation were increased, while pupal weight was decreased. Adult's longevity showed insignificant effects, while female fecundity and egg % fertility showed significant response.

Results of the toxic effect of the three tested formulations of neem extract on the albino mice clearly showed that the determined acute oral LD_{50}, values were 113.33, 134.83 and 140.90 mg/kg for loaded nano-emulsion, nano-emulsion and bulk neem extract, respectively which indicate that the nano formulations was more toxic than the bulk one. In addition, the sub-acute administration of sub-lethal dose (LD_{10}) during 14 days showed significant alterations between induction and/or reduction in the selected biomarkers, *i.e*. hematological toxicity (Hemoglobin, RBCs, WBCs), hepatotoxicity (AST, ALT, Glutathione S-transferase, Reduced glutathione and Bilirubin), nephrotoxicity (Creatinine) and total ATPases.

As general conclusion, the nano-fomulation exhibited more efficiency against the targeted insect pests at biological and biochemical levels while caused serious toxic effect on the utilized mammalian model which indicate the necessary to perform more toxicological studies, *i.e*. chronic and/or long term toxicity studies.

Keywords: *Azadirachta indica, Mentha pipreta,* Neem oil, *Agrotis ipsilon, Spodoptera littoralis*, Nanotechnology, Enzyme activities, Toxicity, Biology.

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