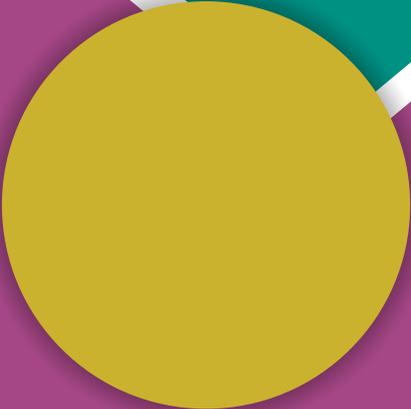


Microbial and non-conventional management practices for tomato fruitworm *Helicoverpa armigera* Hübner (Lepidoptera: Noctuidae) in Punjab



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This project represents the first research study on the distribution, losses, microbial and non conventional integrated management of *H. armigera* on tomato (*Lycopersicon esculentum* Miller) in Punjab, Pakistan. In this project the larvae were reared on the novel artificial diet developed in the laboratory and was compared with the existing available diets. The blending of chickpea (*Cicer arietinum* L.) and red kidney beans (*Phaseolus vulgaris* L.) flour mixed with tomato paste proved highly favorable for the adult reproduction and did not decline the vitality of the tomato fruitworm, this is one of the most significant outcome of the project. In different assays, the combination of *Beauveria bassiana* and *B. thuringiensis* toxin proved effective in combination rather than their alone treatments. The lower dose of *B. bassiana* with both concentrations of *B. thuringiensis* showed additive effect on mortality of *H. armigera* while higher dose of *B. bassiana* synergistically enhanced the mortality. Similarly, the applications of nuclear polyhedrosis virus (NPV) with *B. thuringiensis* proved effective against tomato fruitworm by extending the larval and pupal growth and decreasing the adult duration when neonates were fed on NPV and *B. thuringiensis* mixed diet. Similarly, the combinations of NPV with *Azadirachta indica* and chlorantraniliprole gave higher mortality, reduced pupation and produced additive effect compared to their alone applications for all test populations of *H. armigera*. These tactics were validated in the tomato fields, the chlorantraniliprole was found the most effective with minimum larval population and fruit infestation which lead to the highest yield and cost-benefit ratio (CBR), on the other hand, the maximum number of natural allies viz *Chrysoperla carnea*, spiders, *Tetranychus* species, lady bird beetle and predatory bugs were recorded in plants sprayed with BION. In another field trial, the nuclear polyhedrosis virus (HaNPV), *B. thuringiensis*, *B. bassiana*, Jasmonic acid (JA) alone and in

combination was evaluated for the sustainable management of this notorious insect pest. All the treatments significantly reduced the larval population of *H. armigera* when compared to untreated control. The combined application of HaNPV + chlorantraniliprole was found to be superior among all other treatments in reducing larval population, fruit losses and increasing yield. The trials conducted during present study present the baseline data on the management of tomato fruitworm suggesting the potential use of microbial control agents as the integral part of successful integrated management program of fruitworm in tomato production systems.