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## Additive and Synergistic Interaction Amongst *Orius laevigatus*, Entomopathogens and Neem for Western Flower Thrips Control

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### Abstract

There is a global tendency towards reducing the use of synthetic pesticides because of the associated problems of resistance, environmental contamination, adverse effect on non-target organisms and demand for pesticide-free foods. This has stimulated the search for novel and diverse control strategies as in the case of western flower thrips (WFT), a deleterious pest in several horticultural crops. However, when WFT occurs in high densities and continuously, use of a single biocontrol agent may not ensure fast and reliable control. The use of soft selective biopesticide for fast knock down effects in combination with slow reacting but persistent biocontrol agents may be a sustainable solution. Moreover targeting specifically foliage and soil dwelling life stages may enhance control efficacy. Hence, this study evaluated the interaction among the foliage-dwelling predator *Orius laevigatus*, and soil applied entomopathogens and neem for the control of WFT. The predator *Orius laevigatus* (Fieber) Re-natur was introduced at different rates and also targeted different life stages of WFT. Commercially available biocontrol products evaluated for soil treatment were *Steinernema carpocapsae* (Weiser) Nemastar®, and a non commercial isolate of *Metarhizium anisopliae* (Metschnikoff) Sorokin ICIPE-69 and Neem Azal-T solution. Interactions among the treatments were mostly additive except of two (*Orius* + Neem and *Orius* + *M. anisopliae* ICIPE-69 + *Steinernema carpocapsae*) showing synergistic responses. Efficacy against WFT was significantly improved when the treatments were combined achieving, 83–97% reduction in WFT emergence, compared to single treatments resulting in reductions of 45–74%. Significant differences were observed between efficacy of *Orius* and *M. anisopliae* ICIPE-69 as well as among combinations with *Orius* and other combinations. Adding secondary mortality due to mycosis for the fungi based treatments total effects of 93–99.6% reduction in survivals were recorded. The combined use of the foliage dwelling predator and the soil application of Neem Azal-T and the entomopathogens may be the most promising measures to increase the efficacy and reliability of biocontrolling WFT.

**Keywords:** Additivity, Azadirachtin, biorationals, *frankliniella occidentalis*, *Orius laevigatus*, synergism