In vivo effect of PBO on esterases from *Helicoverpa armigera* and *Bemisia tabaci*

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ABSTRACT

Piperonyl butoxide (PBO) is a commercially important and successful insecticide synergist against a variety of insects in household situations and against public health pests. In agriculture its use tends to be restricted primarily to its wide scale use against cotton bollworm, Helicoverpa armigera *(Hübner) (Lepidoptera: Noctuidae). It is deployed in the field to help partially restore the efficacy of conventional insecticides that are currently compromised by metabolic based resistance. It has been established that PBO inhibits some insect esterases associated with insecticide resistance (Gunning* et al.*, 1998; Moores* et al.*, 1998; Young* et al.*, 2002). Current methodology utilizes a 0.5 hr pre-treatment of PBO prior to insecticide exposure, and as a tank mix in the field. However, research provided here demonstrates that this protocol may not be sufficient for optimum inhibition of metabolic systems. Kinetic esterase assays using* H. armigera *and cotton whitefly* Bemisia tabaci *Gennadius (Sternorrhyncha: Aleyrodidae), reveal that esterase activity was inhibited by the insecticide synergist, PBO, over a 24 h period for* H. armigera *and 30hr for* B. tabaci. *Esterase inhibition by PBO does not occur immediately after dosage but occurs rapidly, with maximum enzyme inhibition several hours later. After this maximum reduction is reached, a plateau occurs before activity begins to gradually recover until full esterase activity is restored. Laboratory analysis with* H. armigera *and pyrethroids confirmed that maximum synergism occurred at the pre-treatment times corresponding to maximum in vivo esterase inhibition in biochemical studies. These results indicate that with improved temporal application of PBO, it may be possible to restore some pyrethroid efficacy in* H. armigera *and* B. tabaci. *It would also be expected that partial restoration of efficacy with other conventional insecticides currently compromised by esterase based resistance mechanisms would occur.*