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Development of PVC-resin-controlled release formulation for pheromones and use in mating disruption of yellow rice stem borer, *Scirpophaga incertulas*

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Abstract

Half lives of a range of Lepidopteran sex pheromone components incorporated into plasticized polyvinylchloride (PVC)-resin formulations were determined under a range of conditions in a laboratory wind tunnel and in the field in Egypt, Pakistan and India. Increasing aliphatic chain length by two methylene groups increased half lives by a factor of approximately 7.5 at 27 °C. Half lives of saturated aliphatic acetates decreased with increase in temperature by 79.2%, 85.5% and 95% for dodecyl acetate, tetradecyl acetate and hexadecyl acetate, respectively, between 22 and 34 °C. Addition of the polymer-soluble dye, Waxoline Black, improved the stability of labile aldehydes and polyunsaturated compounds incorporated into plasticized PVC under field conditions, although the antioxidant BHT had no effect. Studies confirmed that the formulation was ideally suited for the release of 14-carbon acetates and 16-carbon aldehydes with typical field lives of 70–100 days. A PVC-resin formulation of sex pheromone was tested for mating disruption of yellow rice stem borer, *Scirpophaga incertulas*, in replicated 1 ha plots in India over two seasons. Even at an application rate of 10 g a.i./ha/season there was a significant reduction in damage relative to that in plots treated with insecticides. However, application rates of 30–40 g a.i./ha/season are recommended for general use by farmers.

Keywords: Mating disruption; Pheromones; PVC-resin formulation; Controlled release; *Scirpophaga incertulas*

1. Introduction

Lepidopteran female sex pheromones utilize straight-chained aliphatic compounds of between 10 and 23 carbon atoms, derived from fatty acids. A typical Lepidopteran sex pheromone consists of two or three structurally related compounds in a specific ratio. The compounds often contain an oxygenated functional group; these can be terminal groups such as acetates, alcohols or aldehydes or functional groups positioned at specific locations on the carbon chain, such as epoxides and ketones. Unsaturation is common in Lepidopteran sex pheromones usually comprising between one and three double bonds with specific positional and geometric stereochemistry (Witzgall et al., 2004). The specificity and high level of bio-activity of Lepidopteran sex pheromones have attracted considerable interest in crop pest control (Howse et al., 1998; Wyatt, 1997) using a range of techniques, including disruption of male moth orientation leading to mating disruption (Sanders, 1997) and attraction to a lethal source, as in lure-and-kill and mass trapping (Cork et al., 2003; El-Sayed et al., 2006) or, more recently, a non-lethal source as in auto-confusion (Howse, 2004). Control by techniques that involve male attraction invariably require less pheromone than mating disruption and so are potentially more cost-effective, although this advantage can be mitigated by the need purchase and maintain trap systems and

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