COMPARISON OF PVC AND POLYETHYLENE DISPENSERS FOR RELEASE OF GRANDLURE FOR BOLL WEEVIL CONTROL

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Abstract

Release of Grandlure, the pheromone of the boll weevil, *Anthonomus grandis*, from "matrix" and "reservoir" dispensers was investigated in terms of overall release rate and composition of the volatile blend released. Release from the Plato Industries PVC dispenser is first order, decreasing with age, but the composition of the volatiles released is reasonably constant during the lifetime of the dispenser and is the same as that of the blend in the dispenser. Release of Grandlure from polyethylene sachets is non-linear because the components are released at different rates and the composition of the volatiles released varies markedly during the lifetime of the dispenser. Significant decomposition is observed. PVC sachets show promise as dispensers for Grandlure which will release a blend of constant composition at a constant release rate.

Introduction

The boll weevil, *Anthonomus grandis* (Coleoptera: Curculionidae), is a pest of cotton in North, Central and, particularly, South America. A sex/aggregation pheromone produced by the male weevils has been shown to consist of four components, Grandlure I-IV (Fig. 1) (Tumlinson *et al.*, 1969). The pheromone is widely used to monitor and control of the pest, e.g. the Plato Industries Boll Weevil Attract and Control Tube (BWACT) (Plato and Plato, 1997).

The aim of this work was to develop dispensers for Grandlure that provide constant release rates which could be manipulated to various requirements and specifications. Sachet, "reservoir"-type dispensers have previously been shown to release single components at a constant, zero-order rate which can be varied by changing the size of the sachet and thickness of the wall (Torr *et al.*, 1997). The potential of these as dispensers for Grandlure was investigated in comparison with a commercially-available, "matrix"-type dispenser.

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Materials and Methods

Experiments were carried out in a constant temperature room at 27˚C. Formulations were maintained in a wind tunnel at 8 kph windspeed, and release rates were measured by periodic weighing. The composition of the volatiles released was determined by trapping on Porapak Q and quantitative GC analysis on a non-polar CPSil5CB column.

Results

Release From Plato Industries PVC Dispenser

As expected release from these matrix devices was first order (Fig. 2), but gave an effective lifetime of at least 35 days under the laboratory conditions. The release rate was reduced by 35% when exposed in the BWACT.

The composition of the volatiles released reflected the composition of the material in the dispenser and remained relatively constant during the lifetime of the dispenser (Fig. 3). Moreover, no obvious decomposition products were detected.

Release from Polyethylene Sachets

Release of single substances from sealed polyethylene sachets has previously been shown to be constant, i.e.zero-order (Torr *et al.*, 1997). Release of Grandlure from sachets was also initially constant (Fig. 4).

However, release rate declined as the contents were depleted (Fig. 5) and this was shown to be due to preferential release of the more volatile aldehyde components, (III) and (IV). Thus the composition of the blend released varied markedly during the lifetime of the dispenser (Fig 6).

Furthermore, significant amounts (up to 20%) of four decomposition products were observed in the volatiles after more than 30 days.

Release from PVC Sachets

Based on the above results, studies are being carried out on release from PVC sachets. Initial results indicate that release rates for the Grandlure components are similar such that the overall release rate is constant and the composition of the volatiles released is constant and similar to that of the blend in the sachet.

Conclusions

The Plato Industries PVC dispenser releases the Grandlure components at similar rates such that the composition of the volatiles released is reasonably constant during the lifetime of the dispenser and is the same as that of the blend in the dispenser. However, overall release is first order, decreasing with age.

Release of Grandlure from polyethylene sachets is also non-linear because the components are released at different rates and the composition of the volatiles released varies markedly during the lifetime of the dispenser. Significant decomposition is observed.

PVC sachets show promise as dispensers for Grandlure which will release a blend of constant composition at a constant release rate.

References

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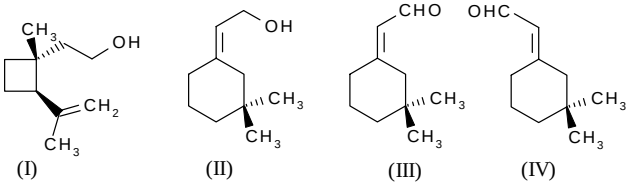

Figure 1. Components of the sex/aggregation pheromone of *A. grandis*

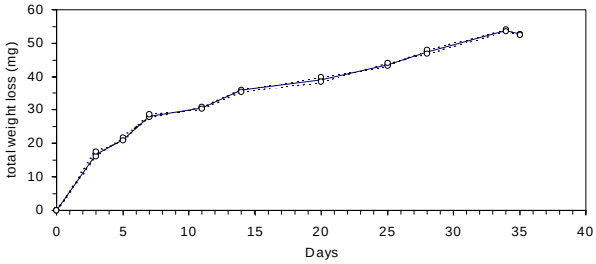

Figure 2. Release of Grandlure from Plato PVC dispenser measured by weight loss (60 mg loading; 27˚C; 8kph windspeed; dotted lines show replicates, solid line is mean)

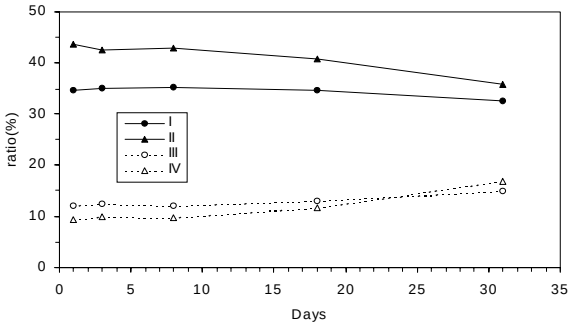

Figure 3. Release of Grandlure from Plato PVC dispenser showing relative amounts of four components in volatiles released, as measured by entrainment (60 mg loading (I):(II):(III):(IV) 35:35:16:14; 27˚C; 8kph windspeed)

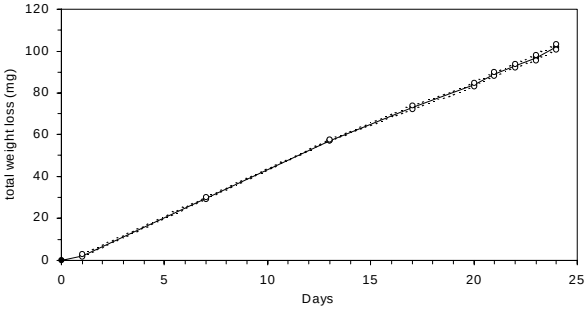

Figure 4 Release of Grandlure from polyethylenesachet (5 cm x 5 cm x 300 μ thick, 1 ml loading; 27˚C; 8kph windspeed; dotted lines show replicates, solid line mean)

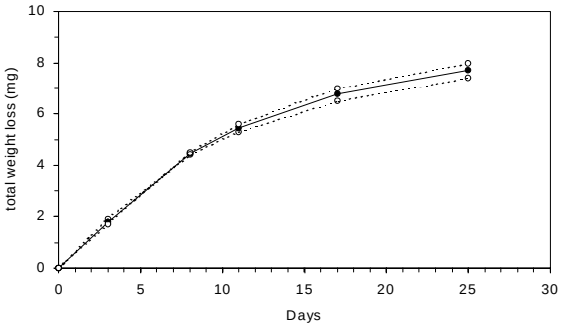

Figure 5. Release of Grandlure from polyethylenesachet (2.5 cm x 2.5 cm x 120 μ thick, 10 mg loading; 27˚C, 8kph windspeed; dotted lines show replicates, solid line is mean).

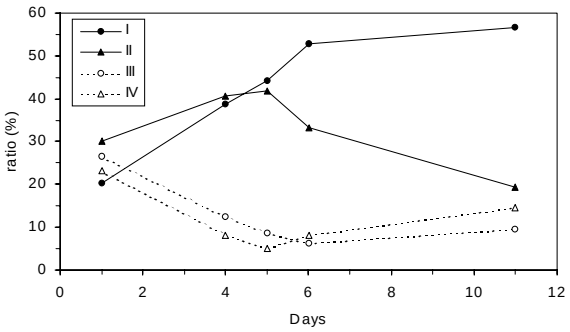

Figure 6. Release of Grandlure from polyethylene sachet showing relative amounts of four components in volatiles released, as measured by entrainment (2.5 cm x 2.5 cm x 120 µ thick, 10 mg loading (I):(II):(III):(IV) 35:35:16:14; 27˚C, 8kph windspeed)