RELEASE KINETICS OF LIQUID FLOWABLE FORMULATIONS OF GOSSYPLURE, SEX PHEROMONE OF THE PINK BOLLWORM MOTH Pectinophora gossypiella SAUNDERS (LEPIDOPTERA: GELECHIIDAE)

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Abstract—The kinetics of the release of gossyplure, measured in the laboratory at 34.5 ± 0.5°C, from two liquid flowable formulations are presented and discussed. The data indicate that liquid flowable formulations, defined as those formulations where the active ingredient (in this case gossyplure) is attached to a particulate material, which in turn is suspended in a liquid medium, probably can be successfully used to disseminate pheromones and other behavior-modifying chemicals, although much work remains to be done in the development of these and other liquid flowable formulations.

Key Words—Pheromone formulations, controlled release, release rate determination, release kinetics, liquid flowables, Pectinophora gossypiella, Lepidoptera, Gelechiidae.

INTRODUCTION

Despite the fact that sex pheromones have been researched for more than 25 years, their successful commercialization and widespread use in plant protection strategies have not yet been realized. One of the major reasons for this is the fact that the development of efficacious and cost-effective controlled release formulations for behavior-modifying chemicals can be a slow and costly undertaking. The question of the principles of the design of such controlled release

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formulations and their use strategies has recently been reviewed (Weatherston, 1988). Currently there are five basic types of commercial formulation available, namely, micro- and macrocapsules, trilaminates, capillaries, ropes, and liquid flowables. Of these five, the liquid flowables are the most recent development, and interest in this type appears to be wide-ranging, research currently being pursued by Montedison (Italy), Dexter Chem. Intl. (Israel), Monterey Chemical [Mitsubishi] (California), Spray Control Systems (Georgia), and Fermone Inc. (Arizona). A liquid flowable formulation is one in which the pheromone is attached to a particulate material that in turn is suspended in a liquid medium.

Liquid flowable formulations of insect sex pheromones can be used in pest management as disruptants or in the bioirritant strategy. This strategy involves the use, usually as a tank-mix, of a pheromone in conjunction with a compatible registered insecticide. Certain adult female lepidopteran insects (Priesner, 1979), including the pink bollworm (Cook and Shelton, 1978), have been shown to detect their own pheromone, and in some cases (Palanaswamy and Seabrook, 1978; Mitchell et al., 1972; Birch, 1977) behavioral responses have been demonstrated. Taking the pink bollworm *Pectinophora gossypiella* as an example, it is envisaged that increased control over either the insecticide alone or the pheromone alone can be achieved by causing increased in-field movement of adults of both sexes, resulting in increased probability of contacting the insecticide.

The intended use of a pheromone in this manner changes some of the design parameters from those of a disruptant formulation; although it will still be desired to utilize all the pheromone within the field use period, it should be possible to utilize a lesser amount of gossyplure and have a shorter longevity period. It is not intended that the longevity of the pheromone should be much different from the concurrently used pesticide.

At this time, we wish to report preliminary laboratory studies carried out on two liquid flowable formulations of gossyplure obtained in 1984 from Rainbow Chemical Inc., Litchfield, Arizona. The two formulations studied were identical in that both contained the same amount of gossyplure (0.632% active ingredient) [(Z,Z)- and (Z,E)-7,11-hexadecadien-1-yl acetate] impregnated onto a particulate material, which, by the use of emulsifiers and surfactants, was suspended in an aqueous medium. The only difference in the formulations was in the choice of particulate material: one formulation utilized Hi-Sil, an amorphous silica (formulation H), while the other contained perlite, a silicate (formulation P).

**METHODS AND MATERIALS**

Gas chromatography (GLC) was carried out on a Hewlett-Packard 5790 capillary gas chromatograph fitted with flame ionization detectors and coupled to a Hewlett-Packard 3390A programmable integrator. The column used was 11.5