EFFECT OF RELEASE RATE AND RATIO OF (Z)-11-HEXADECEN-1-OL FROM SYNTHETIC PHEROMONE BLENDS ON TRAP CAPTURE OF *Heliothis subflexa* (LEPIDOPTERA: NOCTUIDAE)

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Abstract—Response of male *Heliothis subflexa* to pheromone-baited traps containing blends of tetradecanal, (Z)-9-tetradecanal, hexadecanal, (Z)-7-hexadecenal, (Z)-9-hexadecenal, hexadecan-1-ol acetate, (Z)-7-hexadecen-1-ol acetate, (Z)-9-hexadecen-1-ol acetate, (Z)-11-hexadecen-1-ol acetate, (Z)-9-hexadecen-1-ol, and (Z)-11-hexadecen-1-ol was evaluated. Analysis of trap capture data indicated that (Z)-11-hexadecen-1-ol was a critical component of the pheromone blend. It was determined from emission rate data and measurements of the ratio of pheromone components emitted from rubber septa tested that a significant increase in trap capture of male *H. subflexa* occurred when the blends investigated released the alcohol in a narrow range relative to the total amount of pheromone emitted. The optimum range of release ratio of the alcohol for the capture of males in sticky traps was determined to be 0.9–3.5% of the pheromone blend. This release ratio range was reduced to 0.9–1.6% when bucket traps were used.

Key Words—Pheromone formulation, trap design, insect behavior, pheromone specificity, *Heliothis subflexa*, Lepidoptera, Noctuidae.

INTRODUCTION

*Heliothis subflexa* is a major pest of cultivated ground cherry (*Physalis* spp.) in Mexico. In the United States, interest in *H. subflexa* is due to the potential use of hybrids that result when *H. subflexa* females and *Heliothis virescens* males are mated (Laster, 1972). The male progeny produced are sterile, and the fertile females continue to produce sterile male offspring. This discovery provides a
potential for population suppression of *H. virescens* by the introduction of sterile hybrid insects into wild populations. A better understanding of the pheromone components of the parent species will compliment ongoing research regarding the biochemistry of pheromone production and provide improved pheromone blends for monitoring *H. subflexa*.

The sex pheromone components found in ovipositor extracts of *H. subflexa* have been reported by Teal et al. (1981) and Klun et al. (1982). These reports did not provide detailed information regarding the optimum pheromone blend for use as a trap bait. Our efforts to utilize the synthetic blends of components previously reported resulted in highly variable captures of *H. subflexa* males. Captures of male *H. subflexa* in traps baited with synthetic pheromone often were significantly lower in numbers compared to traps baited with sexually mature virgin female *H. subflexa*. Recently, Heath et al. (1990) investigated the periodicity of pheromone production and release from sexually mature *H. subflexa* and *H. virescens* females during various times in the scotophase. During this investigation, it was determined that a small percentage of (Z)-11-hexadecen-1-ol was emitted by calling female *H. subflexa*. Based on this, we subsequently investigated the blend of chemicals required for optimum trap catch of *H. subflexa*. We report here the effect that small amounts of (Z)-11-hexadecen-1-ol, emitted over a narrow range, has on the trapping of male *H. subflexa* when added to previously reported sex pheromone components. Capture of male *H. subflexa* in traps baited with pheromone blends containing various ratios of the alcohol also were compared and the optimum release rate of the optimum ratio determined.

**METHODS AND MATERIALS**

*Formulations.* Synthetic pheromone blends were formulated on rubber septa (#8153-022, A.H. Thomas Co., Philadelphia, Pennsylvania) that were extracted with methylene chloride for 24 hr and air dried prior to formulation. The percentage by weight of a component added to the blend was calculated on the basis of its relative volatility determined from retention indices on liquid crystal capillary gas chromatographic (GC) columns (Heath and Tumlinson, 1986) and a method developed to predict release ratios of components of a blend from rubber septa (Heath et al., 1986). Each septum was loaded with 100 µl of a hexane solution of the blend pipetted into the well on the large end of the septum. Septa were allowed to equilibrate 48 hr prior to use.

Qualitative and quantitative analysis of material loaded on the septa were obtained using a Hewlett-Packard model 5890 gas chromatograph equipped with splitless capillary injectors and flame ionization detectors. A Nelson 4000 data