1-OCTEN-3-OL, ATTRACTIVE SEMIOCHEMICAL FOR FOREIGN GRAIN BEETLE, *Ahasverus advena* (WALTL) (COLEOPTERA: CUCUJIDAE)

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Abstract—Volatiles were captured on Porapak Q from foreign grain beetles, *Ahasverus advena* (Waltl), feeding on rolled oats at various population densities. At low population density, males, females, and mixed-sex beetles four to six weeks posteclosion and older produced 1-octen-3-ol. Mixed-sex beetles emitted almost pure (R)-(−) enantiomer. Weekly production rates of 1-octen-3-ol by males were at least four times greater than those of females. Production of 1-octen-3-ol was barely detectable in volatiles from mixed-sex adults maintained at the highest population density. Laboratory bioassays in a two-choice, pitfall olfactometer modified to retain responding beetles revealed that 1-octen-3-ol serves as an aggregation pheromone for *A. advena*. Both racemic and chiral 1-octen-3-ols were good attractants for mixed-sex adults in the pitfall olfactometer.

Key Words—*Ahasverus advena* (Waltl), foreign grain beetle, Coleoptera, Cucujidae, 1-octen-3-ol, volatile attractant, aggregation pheromone, population density.

INTRODUCTION

The foreign grain beetle, *Ahasverus advena* (Waltl), is a cosmopolitan pest of stored products. Primarily fungivorous, *A. advena* usually infests damp and

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decaying, mold-damaged cereals, oilseeds, and other stored food (Sinha and Watters, 1985). The insect develops well on pure cultures of common storage fungi (David et al., 1974), and larvae and adults exhibit elevated levels of chitinolytic enzymes, indicating that fungal chitin can be utilized as a food source (Fukamizo et al., 1985). There are observations, however, confirming direct feeding on foods in the absence of visible mold (Woodroffe, 1962).

Identification of attractive semiochemicals for *A. advena* could lead to the development of integrated control programs (Levinson and Levinson, 1979; Burkholder, 1981). To date, we have found that males of six species of economically damaging, cucujid grain beetles produce aggregation pheromones (Oehlschlager et al., 1988). An additional aggregation pheromone, 1-octen-3-ol, was found to be produced by males and females of two of these species, *Oryzaephilus surinamensis* (L.) and *O. mercator* (Fauvel), when adults were maintained at low population densities in aeration cultures (A.M. Pierce et al., 1989).

The objective of the present study was to identify beetle-produced, attractive semiochemical(s) for adult *A. advena*.

**METHODS AND MATERIALS**

**Insect Rearing.** *A. advena* were reared at 28°C and 65-70% relative humidity in darkness. Stock cultures were set up in 3.8-liter glass jars containing 1 kg of large-flake, rolled oats and brewer's yeast (95:5, w/w) with an inoculum of 2500 adults. The medium initially had been sprayed with 80 ml of distilled water and mixed well. Numbers of adults were determined by mean weight (1 beetle = 0.42 mg, *N* = 1600).

**Beetles for Aerations.** Beetles were sexed as pupae by examination of the genital papillae (Halstead, 1963) using the following procedure. Late-stage larvae were removed from stock cultures and placed individually in 3.7-ml shell vials each containing a moistened oat flake. The open vials were kept at 28°C and 65-70% relative humidity in darkness until pupation occurred. Prior to sexing, pupae were placed on several layers of moistened filter paper in covered, 150-mm-diam. glass Petri dishes to loosen the posterior attachment of the last larval exuvia. After 30 min at approx. 24°C, the softened exuvia was gently removed from the tip of the abdomen with a fine brush and the sex determined. The segregated sexes were returned to jars of moistened rolled oats at approximately the same densities as used in aerations. Unless stated otherwise, for mixed-sex aerations, late-stage larvae were transferred directly to jars of moistened oats at the appropriate density. The beetles were kept at 28°C and 65-70% relative humidity until used in aerations as adults.

**Collection of Volatiles.** Volatiles from male, female, or mixed-sex beetles...