STEGOBIOL, A NEW SEX PHEROMONE COMPONENT OF DRUGSTORE BEETLE (*Stegobium paniceum* L.)

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**Abstract**—New sex pheromone component of female *Stegobium paniceum* L. was isolated and identified as 2,3-dihydro-2,3,5-trimethyl-6-(1'-methyl-2'-hydroxybutyl)-4H-pyran-4-one, stegobiol, by spectral data and chemical conversion from stegobinone. Relative configuration at C-2, C-3, and C-1' was determined as 2'S,3'R, 1'S by the conversion from (2'S,3'R, 1'R)-stegobinone. This new sex pheromone elicits the pheromonal response from the species.

**Key Words**—Sex pheromone, drugstore beetle, *Stegobium paniceum* L., Coleoptera, Anobiidae, stegobiol.

**INTRODUCTION**

The drugstore beetle, *Stegobium paniceum* L., is a devastating pest of stored grain. The structure of the sex pheromone has been established as 2,3-dihydro-2,3,5-trimethyl-6-(1'-methyl-2'-oxobutyl)-4H-pyran-4-one, stegobinone (Kuwahara et al., 1975, 1978), and subsequent study determined the absolute configuration at C-2, C-3, and C-1' to be 2'S,3'R, 1'R (Hoffmann et al., 1981). Stegobinone elicits precopulatory searching behavior from the males of the species (Kuwahara et al., 1975). Recently, we reported that stegobinone elicited not only searching but also mating behavior, and its pheromonal activity was inhibited by its 1'-epimer (Kodama et al., 1987). In the course of our study, we confirmed the presence of another sex pheromone component which we named stegobiol according to its structural similarity to stegobinone.
Here, we report the isolation and structural determination of this new sex pheromone.

METHODS AND MATERIALS

The insects were reared on mouse diet at 28 ± 1°C and 60 ± 10% relative humidity. Male pupae were removed from cultures and isolated from females by observance of the characteristics described by Azab (1954). Selected male pupae were transferred into a separate room from that used for culturing and placed in a female-free incubator at 28 ± 1°C and 60 ± 10% relative humidity. The isolated insects were kept in the incubator until tested when 8–10 days old.

Instrumentation. Analytical gas chromatography (analytical GC) was performed using a Shimadzu 7A equipped with FI detector and a 50-m × 0.2-mm-ID fused silica column coated with Carbowax 20 M. The column temperature was programmed at 2°C/min from 100 to 210°C. High-performance liquid chromatography (HPLC) was performed with a Hitachi 655 constant flow pump, and for monitoring the column’s effluent a UVILOG-5A UV detector (Oyo-Bunko Kiki Co., Ltd., Tokyo) was used. Mass and IR spectra were measured on a Hitachi M-80 and Nicolet 60SX instruments, respectively. Proton and 13C NMR spectra were obtained with a Bruker AM 500 NMR spectrometers. The chemical shifts are expressed as ppm downfield from Me₄Si as an internal standard. Two-dimensional NMR experiments were performed on a Bruker AM 500 NMR spectrometer using available 2D software. The data size of the time domain of the correlated spectrum (COSY) was a 512 × 2048 matrix. To improve the spectral resolution, these data were multiplied in both directions with a sine bell function. Fourier transformation was performed with zero filling in tl direction. Heteronuclear-shift-correlated 2D NMR was processed in a similar way. The data size of the time domains was 256 × 2K.

Isolation of Pheromone. Drugstore beetles of both sexes (150,000 adults) were extracted twice with hexane (1 liter, each). After removing the solvent

Fig. 1. The structure of the pheromones (1: stegobiol, 2: stegobinone).