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Abstract—Ovipositor washings from virgin female *Earias vittella* (F.) (Lepidoptera: Noctuidae) moths were examined by gas chromatography (GC) linked to electroantennography (EAG). Six components were detected by the male moth. These were identified by comparison of their retention times with those of a range of synthetic standards on fused silica capillary GC columns as hexadecanal, (Z)-11-hexadecenal, (E,E)-10,12-hexadecadienal, octadecanal, (Z)-11-octadecenal, and (E,E)-10,12-hexadecadien-1-ol in 1:2:10:2:4:1 ratio. Field testing in Pakistan showed that a 2:10:2 mixture of (Z)-11-hexadecenal, (E,E)-10,12-hexadecadienal, and (Z)-11-octadecenal was as attractive to male *E. vittella* moths as the six-component mixture and equal in attractiveness to a virgin female moth. Omitting (Z)-11-hexadecenal or (Z)-11-octadecenal greatly reduced this attractiveness. It was found that synthetic lures must be protected from sunlight to prevent loss of attractiveness caused by isomerization of the conjugated diene aldehyde, and addition of (E,Z)-10,12-hexadecadienal was shown to reduce attractiveness significantly. During this work, a 10:1 mixture of (E,Z)-10,12-hexadecadienal and (Z)-11-hexadecenal was shown to be as attractive to *E. insulana* (Boisd.) male moths as a virgin female moth, and the attractiveness of this mixture was further increased by addition of (E,Z)-10,12-hexadecadienal.

INTRODUCTION

The spotted bollworm, *Earias vitellia* (F.) (Lepidoptera: Noctuidae) is an important pest throughout the cotton-growing areas of the Indian subcontinent, southeast Asia, Indonesia, and northern Australia. The female moth lays eggs singly on the cotton bolls, and the larvae develop entirely within the cotton boll, reducing the quantity and quality of the cotton lint. Control with conventional insecticides is made difficult by the inaccessibility of the larvae. Control by novel methods, such as mating disruption with sex pheromones, necessitates the development of a sensitive, species-specific monitoring tool. This is particularly important in Pakistan where *E. vitellia* coexists with the closely related spiny bollworm, *E. insulana* (Boisd.) (Lepidoptera: Noctuidae), and the pink bollworm, *Pectinophora gossypiella* (Saund.) (Lepidoptera: Gelechiidae). The sex pheromone of *P. gossypiella*, (Z,E)- and (Z,Z)-7,11-hexadecadienyl acetates, is well known (Bierl et al., 1974), and the major component of the sex pheromone of *E. insulana* was identified as (E,E)-10,12-hexadecadienal by Hall et al. (1980). This paper describes the identification and field evaluation of the female sex pheromone of *E. vitellia*. Preliminary results were reported briefly by Cork et al. (1985a).

METHODS AND MATERIALS

*Insect Material.* For chemical analyses, pupae were sent from India by air to London. The pupae were left in their cocoons and placed in individual tubes held in an environmental cabinet on a reversed 12-hr/12-hr light–dark cycle with temperature alternating between 27°C and 22°C and relative humidity 85%. Adult moths were sexed on emergence and provided with 10% sucrose solution under the same conditions.

For field work in Pakistan, larvae were collected from cotton bolls, separated from *E. insulana* larvae, and reared on fresh cotton seeds. The resulting pupae were removed from their cocoons, sexed, and maintained singly in tubes on moist cotton wool until emergence.

*Pheromone Collection.* Ovipositor washings in carbon disulfide or heptane were prepared from virgin female moths up to 3 days old and between 4 and 12 hr into the dark period. Volatiles from virgin female moths were collected