CHEMICAL COMMUNICATION IN THE MATING BEHAVIOR OF Trogoderma glabrum (HERBST) (COLEOPTERA: DERMESTIDAE)

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Abstract—Male mating behavior of the stored product pest beetle Trogoderma glabrum (Herbst) was analyzed into three major phases: arousal/searching, preliminary recognition, and genital (copulatory). Airborne pheromone released by calling females elicits male arousal via antennal sensillae. Contact chemoreception via male mouthpart sensillae appears to be necessary for copulation to occur. A procedure was developed for quantitative bioassay of presumptive pheromone compounds in both airborne and contact chemoreception. (E)-14-methyl-8-hexadecenal, present in airborne pheromone, but not detectable in extracts of whole females, elicits both arousal and attempted copulation. The activity of (E)-14-methyl-8-hexadecenal is equal to that of the total airborne pheromone. Activity of additional possible pheromone component candidates [including (E)-14-methyl-8-hexadecen-1-ol, \( \gamma \)-caprolactone, \( n \)-hexanoic acid, and methyl (Z)-7-hexadecenoate] was investigated. Evidence for a behavioral role for \( n \)-hexanoic acid is presented.

Key Words—pheromone, mating, Trogoderma, Dermestidae, Coleoptera, behavior, airborne pheromone, calling, Trogoderma glabrum, (E)-14-methyl-8-hexadecenal.

INTRODUCTION

Within the genus Trogoderma (Coleoptera: Dermestidae) are several serious stored product pests of relatively cosmopolitan distribution. We report...
here work on the biology of mating and the chemical communication system of *T. glabrum*, one aspect of the development of a pheromone trapping/disease dispersal control system for *Trogoderma* spp. (Schwalbe et al. 1974).

Females of *T. glabrum* produce a sex pheromone, released during calling in a circadian rhythm (Hammack and Burkholder 1976, Hammack et al. 1976). The pheromone will elicit arousal in conspecific males and attraction to the pheromone source (Burkholder and Dicke 1966). Compounds with pheromone-like activity have been isolated from whole females, characterized chemically, and assayed for biological activity in eliciting a relatively non-specific arousal response (Yarger et al. 1975).

Knowledge of the role of all the components of the pheromone complex will presumably allow more selective attraction of the species of *Trogoderma*, and also more efficient trapping over long distances. We therefore analyzed the mating behavior of *T. glabrum*, especially from the point of view of sensory structures and chemical signals involved in mediating changes in behavioral state. We observed mating behavior in normal insect pairs, and in pairs including males from which the antennae or mouthparts, or both, were surgically removed. A recently devised method for the simple and efficient collection of a relatively large quantity of airborne compounds (Byrne et al. 1975) allowed us to compare the chemistry and activity of released pheromone with active compounds isolated from extracts of macerated whole females.

**METHODS AND MATERIALS**

Insects were obtained from cultures that had been maintained for about 15 yr in the Stored Product Insects Laboratory, Madison, Wisconsin, and were reared as described in Hammack et al. (1973). Insects were removed from the culture as pupae and sexed on the basis of body size; females were returned to the rearing chamber, males were placed in a female-free incubator. Insects were maintained on a 16:8 light:dark photocycle, with lights-on at 7 a.m. CDT.

**Sensory Ablation and Experimental Mating**

Under light ether anesthesia, experimental males had antennae or maxillary palps, or both, removed mechanically. The appendages were grasped at the base with fine jewelers’ forceps and pulled off. This procedure resulted in 100% survival. For insects treated in this way, control insects were of two types: those not operated on, and those with antennae or maxillary palps or both, removed unilaterally. Since the labial palps were too small and