KAIROMONES AND THEIR USE FOR MANAGEMENT OF ENTOMOPHAGOUS INSECTS: II. MECHANISMS CAUSING INCREASE IN RATE OF PARASITIZATION BY *Trichogramma* spp.\(^1,2,3\)

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Abstract—When the effect of the kairomone, tricosane, on parasitization by *Trichogramma achaearae* Nagaraja and Nagarkatti of eggs of *Heliothis zea* (Boddie) was studied in petri dish tests, the greatest percentage parasitization ($\bar{X} = 64\%$) was obtained if the entire filter paper was treated. Treatment of smaller areas (about the eggs) resulted in decreased parasitism. In the greenhouse, highest parasitization ($\bar{X} = 71\%$) by *T. pretiosum* (Riley) of *H. zea* eggs placed on pea seedlings grown in pie pans was obtained if the whole pan was treated; lowest parasitism ($\bar{X} = 29\%$) occurred when the pans were untreated. Parasitization was intermediate ($\bar{X} = 52\%$) in other pans treated only at selected spots. Dissections of *H. zea* eggs collected from kairomone-treated and untreated field plots revealed that eggs of *Trichogramma* spp. were more efficiently distributed (less superparasitism) among host eggs in treated plots. These kairomones increase parasitization of *Trichogramma* spp. by releasing and continuously reinforcing an intensified searching behavior rather than by attracting and guiding the parasite directly to the host.

Key Words—*Trichogramma achaearae*, *Heliothis zea*, biological control, kairomones, pest management, parasitoids, host finding, insect behavior, pheromones, behavior chemicals.

\(^1\) Hymenoptera: Trichogrammatidae.
\(^2\) In cooperation with the University of Georgia College of Agriculture Experiment Station, Coastal Plain Station, Tifton, Georgia.
\(^3\) Mention of a proprietary product in this paper does not constitute an endorsement of this product by the USDA.
INTRODUCTION

The results of the previous report in this series demonstrated that field plot application of tricosane or similar appropriate kairomone(s) resulted in increased rates of parasitization by certain Trichogramma spp. (Lewis et al., 1975). It was also demonstrated that the kairomone did not have to be limited to the immediate vicinity of the host eggs, but increased parasitization when applied by blanket spraying of the material throughout the plot. These data suggested that the kairomone functioned primarily as a releaser to elicit a more intensified search pattern in treated areas rather than as a trail substance or attractant which might guide parasites to host eggs. The present studies were designed to elucidate the behavior modification(s) causing increased parasitization.

METHODS AND MATERIALS

Petri Dish Test

Comparative evaluations were made of rates of parasitism by T. achaeae Nagaraja and Nagarkatti of Heliothis zea (Boddie) eggs in petri dishes with different treatment patterns. The bottom of each 150 x 15-mm petri dish was covered with a piece of 13.8-cm Whatman No. 1 filter paper which was marked with a pencil at 6 different locations in a pattern which would allow maximum separation of the eggs. The kairomone, tricosane, was applied to the paper at the rate of 50 ng/cm² using a hypodermic syringe. Each piece of filter paper was treated according to 1 of 4 patterns: circles of 1.2 cm, 2.0 cm, or 3.7 cm in diameter around each designated egg location, or treatment of the entire piece of paper. Eggs were attached to the papers at each of the 6 locations using a spot of rubber cement. Two freshly emerged T. achaeae females were introduced into each dish and allowed to search for 45 min, after which the eggs were dissected to determine parasitization according to the method described by Lewis and Redlinger (1969). For each treatment pattern 10–20 replications of this test were conducted.

Greenhouse Studies

A comparison was made in the greenhouse of the parasitization rates by T. pretiosum (Riley) of the eggs of H. zea placed on plants having different treatment patterns. Crowder pea seedlings grown in 22.8-cm pie pans were used. The 3 treatment patterns evaluated were (1) complete coverage application of the kairomone (blanket treatment), (2) application at restricted locations (partial treatment), and (3) untreated controls. An aerosol chroma-