HOST-SPECIFIC RECOGNITION KAIROMONE FOR THE PARASITOID Microplitis croceipes (CRESSON)

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Abstract—A water-extractable host recognition kairomone in frass of corn earworm, Helicoverpa ze a Boddie (Lepidoptera: Noctuidae), host larvae stimulates antennation by females of the parasitoid Microplitis croceipes Cresson (Braconidae: Hymenoptera). In addition, when the wasps contact water extracts of host frass they will subsequently fly in a flight tunnel to odor associated with the extract. Contact with water extracts of cowpea leaves or with water extracts of frass from larvae of nonhost beet armyworm, fall armyworm, or cabbage looper that were fed cowpea leaves does not stimulate antennation; nor do wasps fly to associated odors after contact with these substances. However, contact with the water extract of host frass in association with hexane extract of cowpea-fed nonhost frass will induce the wasps to subsequently fly to the hexane extract of the nonhost frass when it is used as an odor source in a flight tunnel. Thus the host-specific kairomone by which M. croceipes recognizes the frass of its host is extractable with water. This substance plays a crucial role in the foraging behavior of this parasitoid by allowing it to recognize host frass and to learn to search for odors originating from plants on which the host is feeding.

Key Words—Associative learning, recognition kairomone, host specific, Microplitis croceipes, corn earworm, Helicoverpa ze a.

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INTRODUCTION

The oligophagous wasp *Microplitis croceipes* (Cresson) attacks only *Heliothis* and *Helicoverpa* larvae (Lewis, 1970), which are polyphagous and severe pests on several important crops such as corn and cotton. *M. croceipes* is considered a candidate for biological control of these pest insects (Lewis, 1970), but its use on a practical basis is limited because of a lack of a reliable method for employing it as a control agent. In an effort to develop more effective methods of biological control of insect pests with natural enemies, we have been studying the foraging behavior of insect parasitoids. Artificially reared parasitoids must be able to locate and to recognize their host insects in the field. We must also be able to retain native or released parasitoids in a target crop and keep them searching for hosts.

Semiochemicals associated with the host or the host habitat play a major role in location and recognition of hosts by many parasitoids (Vinson, 1976, 1984; Turlings et al., 1990, 1992). However, it has been shown that females of *M. croceipes*, as well as the closely related *M. demolitor* (Wilkinson), reared in the laboratory on host larvae fed artificial diet do not respond to host-related cues released by a natural plant–host complex, unless first given a brief encounter with plant-fed hosts or their products (e.g., frass) (Drost et al., 1986; Hérard et al., 1988; Eller et al., 1988). An actual encounter with a host larva is not necessary. After experiencing host frass only, or a combination of water and hexane extracts of the frass, female *M. croceipes* wasps flew in a wind tunnel as often to a volatile source consisting of hexane extract of the frass as to the frass itself. However, after experiencing only hexane extract of frass, the wasps showed a very low flight response, which was not significantly different from the response by inexperienced wasps (Lewis and Tumlinson, 1988). Response after experiencing only water extracts of frass was also very low. The conclusion was that host frass contained recognition kairomones. When the kairomones are perceived by female wasps in conjunction with host-related volatiles, such as those released from host frass hexane extract, the likelihood of subsequent upwind amototactic flight and eventual location of a source releasing the same volatiles is increased. Although antennation of host frass and the subsequent encounter with recognition kairomones will initiate host searching behavior in mated female wasps, this is not simple innate behavior. Lewis and Tumlinson (1988) showed that female wasps also are able to learn to recognize, and subsequently to fly to, novel volatiles, such as vanilla, presented in combination with the host frass. Thus, associative learning is a very important part of the host recognition process.

While antennating host frass on a plant, a naive female wasp (without a