USE OF PAIRED AND SINGLE TRAPS TO ASSESS PERCEPTION AND DISCRIMINATION OF SEX PHEROMONE MIXTURES IN THE FIELD BY Trichoplusia ni (Hübner)

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Abstract—Paired wind-oriented traps (WORT) and single traps were deployed simultaneously in the same field to investigate whether or not inferences about the central nervous system processes of discrimination and perception can be made from differences in moth captures. The stimulus levels deployed were those that typically may be found downwind of a calling virgin female cabbage looper, Trichoplusia ni (Hübner), so that inferences are relevant to natural stimulus intensities. Captures of male cabbage loopers in the WORT traps paralleled prior laboratory measures of pheromone mixture discrimination. The pattern of captures by the two trapping systems probably reflects perceptive and discriminative processing differences in the central nervous system. Captures in traps baited with Z7-12:Ac alone were equal to, or better than, captures in traps baited with three- and six-component mixtures that contained Z7-12:Ac.

Key Words—Behavior, perception, discrimination, trap, sex pheromone.

INTRODUCTION

Traps baited with insect sex pheromones historically have been used in field surveys, in various communication experiments, and as a means of confirming laboratory-derived chemical identifications. In this report we examine captures in field traps that were baited with sex pheromone components to assess the central nervous system (CNS) processes of discrimination and perception. The

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results address questions about pheromone component redundancy and the usefulness of multicomponent information to male cabbage looper, *Trichoplusia ni* (Hübner), behavior in particular. Trap captures are usually only distantly and tacitly linked to studies of perception and discrimination by most investigators. These terms have never been clearly defined and tested in such a way that field captures can be applied successfully to studies of these processes.

The proximate question we examine is whether or not male cabbage looper moths discriminate differences between the single pheromone component, *(Z)-7-dodecenyl acetate (Z7-12:Ac)*, and two mixtures containing Z7-12:Ac with other pheromone components. Previously, Mayer and McLaughlin (1993) found that male cabbage loopers discriminate the individual component, Z7-12:Ac, and different mixtures in the laboratory. For those laboratory assays, discrimination was defined as the difference in response to paired, simultaneously detectable stimuli (Mayer and McLaughlin, 1991, 1993). Stimulus perception is important in signal discrimination, but it is not measured in the same manner. In the laboratory, discrimination was intensity dependent but no pairing ever elicited an all-or-none response to one or the other pheromone component aroma. In addition to confirming the results that have been observed in the laboratory, we asked whether or not the imposition of the stringency of field trap assays would result in more or less clear evidence of mixture discrimination than the laboratory assays.

Discrimination in the field was assayed by use of paired wind-oriented traps (WORT) (Mitchell et al., 1988). The same mixtures that were used in the WORT traps also were used as baits in individual traps to examine whether or not it is appropriate to associate differences in captures between these traps with perception, another CNS process. The WORT system deploys paired traps that always are oriented into the wind. As a result, the plumes from each trap, in theory, are parallel and unmixed for at least a short distance downwind but mix at some further point downwind so that an insect flying upwind detects the plumes simultaneously. It is assumed that differences in captures between the two traps is the result of a difference discriminated between the two baits. These assays are the field analog of the laboratory-based wind-tunnel assays of discrimination (Mayer and McLaughlin, 1991, 1993).

If the WORT system can be used to investigate discrimination, then do single traps measure perception? If perception is defined as the innate recognition of an odor, captures at individual pheromone-baited traps are, indeed, measures of perception. A corollary of these definitions is that an insect can perceive disjoint stimuli, but can not discriminate between them unless it has a memory. Because the terms perception and discrimination are linked to neural processes within the CNS, other terms should be given to the mechanisms and response differences by which peripheral receptor neurons respond differently to different odors.