ATTRACTION AND INHIBITION IN MOTH SPECIES RESPONDING TO SEX-ATTRACTANT LURES CONTAINING Z-11-HEXADECEN-1-YL ACETATE

WARREN STECK, E.W. UNDERHILL, and M.D. CHISHOLM

Prairie Regional Laboratory, National Research Council of Canada, Saskatoon, Canada S7N 0W9

(Received December 20, 1976; revised March 15, 1977)

Abstract—Sex attractants for several sympatric noctuid moths required Z-11-hexadecen-1-yl acetate and additional olefinic compounds (co-attractants) for effective, species-specific operation. In nearly all cases at least one of the co-attractant compounds for each species functioned as a strong inhibitor of one or more of the other species in the group. It was concluded that species specificity in sex attractants can be achieved through conspecific co-attractants which are at the same time transspecific inhibitors.

Key Words—Eurois occulta, Leucania commoides, Scotogramma trifoli, Crymodes devastator, Mamestra configurata, sex pheromones, specificity, Lepidoptera, chemical communication.

INTRODUCTION

Z-11-Hexadecen-1-yl acetate (Z11-16:Ac) is a necessary component of sex attractants for male moths of several species, including the noctuids Mamestra configurata Walker (Chisholm et al., 1975), Scotogramma trifoli Rottentburg (Struble et al., 1975), Eurois occulta L. (Steck et al., 1976), Peridroma saucia Hübner (Struble et al., 1976), Leucania commoides Grote (Struble et al., unpublished), and Crymodes devastator Brace (Steck et al., 1977). The actual attractant mixtures described for each species involve from 2 to 4 chemical components. Species specificity in sex pheromones containing one or more common constituents has been attributed to the presence of different additional co-attractant components, the co-attractants each being effective for a single

1 Issued as NRCC No. 16150.
species. The use of different ratios of common components by related species has also been noted. A wealth of experimental data supports both of these mechanisms (see Roelofs and Cardé, 1974). At the same time, it is known (Sower et al., 1974) that some female moths are capable of releasing with their pheromone certain compounds which prevent males of other species from responding to the pheromone. Natural attractants and inhibitors found to date amongst lepidopterans have almost always had molecular structures very similar to each other, a simple but important fact seldom emphasized in descriptions of the systems. The vast majority of these substances are straight-chain olefins of even carbon number (C<sub>10</sub>–C<sub>18</sub>) with a terminal acetate, aldehyde, or alcohol functional group. The number of different monoolefins of these types known in sex pheromones is in fact small (less than 60) and comprises mostly compounds with C<sub>12</sub>, C<sub>14</sub>, and C<sub>16</sub> carbon chains. The number of binary combinations possible from this number of components—1770—seemed insufficient to provide a complete array of specific attractants for the lepidoptera of our locality, for surveys of field attractancy of several hundred candidate binary lures had shown us that most combinations attracted no species. We therefore undertook a study of other possible chemical communication roles for some of these compounds, with emphasis on interspecific effects of sex attraction or inhibition.

The procedures generally employed in identification of sex pheromones in insects involve collection of the pheromone from females, isolation of the components via fractionation of the collected mixture, chemical identification of the attractant components, and finally confirmation of the laboratory work in field tests. In the laboratory, bioassays and/or antennal response measurements are usually employed during the isolation steps. This approach, sound for the purpose of finding conspecific attractants of a species, is not well suited to revealing interspecific chemical messengers. Discovery of naturally released compounds able to function as specific inhibitors for other species is not possible until the identity of the species being inhibited is first ascertained, which in turn requires at least some knowledge of the character of their sex attractants. Using synthetic sex attractants instead of isolated sex pheromones, we have obtained this information for a model group of noctuid moths all requiring Z-11-hexadecenyl acetate (Z11-16:Ac) for sex attraction. We describe here some experiments on interspecies inhibition within this group.

METHODS AND MATERIALS

Chemicals

The compounds used were synthesized in our laboratory by recognized methods (Warthen, 1968; Struble and Swailes, 1975) and purified isomerically