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A Linkage between Coding of Quantity and Quality of Pheromone Gland Components by Receptor Cells of *Trichoplusia ni*

M. S. MAYER AND R. W. MANKIN

United States Department of Agriculture, ARS
Insect Attractants, Behavior, and Basic Biology Research Laboratory
Gainesville, Florida 32604

The responses elicited in two specialized pheromone receptor cells of *T. ni* by six pheromone gland components link the coding of pheromone quality in the central nervous system (CNS) inextricably with the coding of pheromone quantity.

In a study of quality and quantity coding of *T. ni* sex pheromone components, we have used a combination of various methods, including gas-liquid chromotography, electroantennogram, and radiolabeling, to measure the emission rates of the pheromone gland components from glass and rubber septum dispensers. A newly developed stimulus delivery system controlled the stimulus concentration and duration. Neuronal responses were recorded from a tungsten electrode inserted at the base of a sensillum that contained the receptor neurons. In *T. ni* there are two morphologically distinct sensilla, HS and LS, that contain two or more neurons, designated (a) and (b), whose responses can be distinguished by spike amplitude.[1,2]

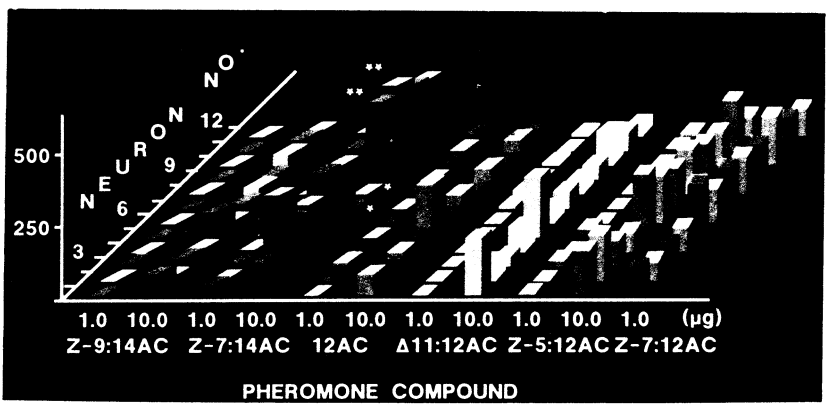

FIGURE 1. HS(a) impulses during three-second stimulus interval. *1.0 μg of new sample; **0.1 μg of new sample.

We found that the HS(a) neuron responded most sensitively to Z-7:12AC, with action potentials elicited at concentrations lower than 1×10^{-11} μmole/cm^3 (FIG. 1). The next most stimulatory gland component for this neuron was Z-7:14AC. Dodecan-1-ol acetate failed to elicit reliable responses until the concentration exceeded about 6×10^{-5} μmole/cm^{-3}. Another neuron in this sensillum, HS(b), responded only to Z-7:12OH at or above such concentrations. A neuron in the other sensillum, LS(b), was most sensitive to Z-7:14AC, with a midrange response at a concentration of 1×10^{-8} μmole/cm^3 (FIG. 2). The LS(a) neuron was not stimulated by any of the pheromone components.

The linkage between quantity to quality coding is evident from the responses where the stimulating doses were increased just one magnitude. Both of the neurons that responded selectively at low doses lost selectivity at the high dose; both the HS(a) and LS(b) neurons responded to all pheromone gland components except Z-7:12OH at stimulus concentrations above about 1×10^{-6} μmole/cm^{-3}. Because HS(a) and LS(b) neurons responded to six of the seven pheromone gland components at these elevated concentrations, it is not clear how the individual components are discriminated by the CNS.

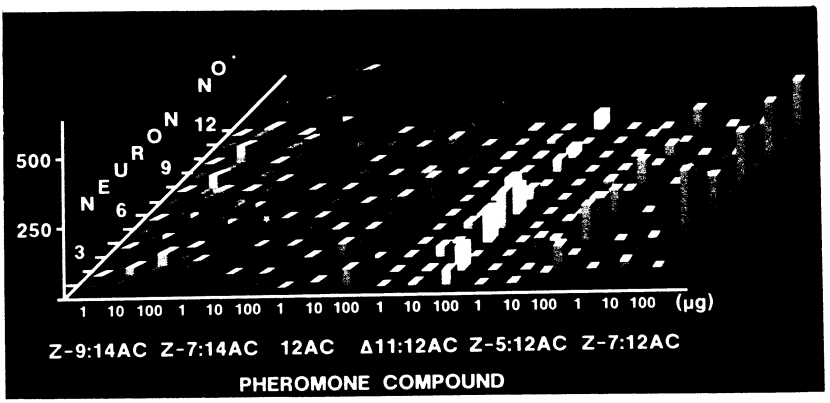

FIGURE 2. LS(b) impulses during three-second stimulus interval. * indicates new sample 0.1 μg dose.

It is evident from FIGURES 1 and 2 that the selectivity of the response to different pheromone components decreases as the stimulus intensity increases. We conclude that neither of these neurons in *T. ni* can be defined as a specialist cell in the sense defined for the bombykol receptor neuron in *Bombyx mori* because of the linkage between quantity and quality. Whether this linkage is unique or general remains to be determined.

REFERENCES

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