Plant odour stimuli reshape pheromonal representation in neurons of the antennal lobe macroglomerular complex of a male moth

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Male moths are confronted with complex odour mixtures in a natural environment when flying towards a female-emitted sex pheromone source. Whereas synergistic effects of sex pheromones and plant odours have been observed at the behavioural level, most investigations at the peripheral level have shown an inhibition of pheromone responses by plant volatiles, suggesting a potential role of the central nervous system in reshaping the peripheral information. We thus investigated the interactions between sex pheromone and a behaviourally active plant volatile, heptanal, and their effects on responses of neurons in the pheromone-processing centre of the antennal lobe, the macroglomerular complex, in the moth Agrotis ipsilon. Our results show that most of these pheromone-sensitive neurons responded to the plant odour. Most neurons responded to the pheromone with a multiphasic pattern and were anatomically identified as projection neurons. They responded either with excitation or pure inhibition to heptanal, and the response to the mixture pheromone + heptanal was generally weaker than to the pheromone alone, showing a suppressive effect of heptanal. However, these neurons responded with a better resolution to pulsed stimuli. The other neurons with either purely excitatory or inhibitory responses to all three stimuli did not exhibit significant differences in responses between stimuli. Although the suppression of the pheromone responses in AL neurons by the plant odour is counter-intuitive at first glance, the observed better resolution of pulsed stimuli is probably more important than high sensitivity to the localization of a calling female.