# Functions of Host Plant Odors in Oviposition Behavior of the Yellow Peach Moth, *Conogethes punctiferalis* (Guenée)

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# Summary

Chemostimulative functions of airborne stimuli in behavioral regulation of oviposition by *C. punctiferalis* were investigated by laboratory cage and wind tunnel tests, where host-plant odors and plant-derived $CO_2$ were manipulated. Effects of biophysical factors on oviposition responses induced by plant odors were also assessed. Results obtained are summarized as follow.

Normal oviposition responses were observed to plant odors of 3 typical host plants, but 13 non-host plants including turnip and Brussels sprout also induced oviposition. No or reduced responses were observed to tuber and leaf odors of potato as an absolute non-host. These results reveal that many non-host plants have potentials as oviposition hosts, even if some are seasonally or spatially isolated from females. Females remarkably preferred odors from young fruits of 3 host plants, indicating olfactory stimuli of fruits are qualitatively and quantitatively different from other parts. Concentrated egg distribution at concave structures on exposed plant materials clearly indicates crucial modulation by biophysical stimuli as an additional factor in oviposition site selection.

Under sustained and transiently manipulated plant odor stimuli, functions of the plant odors on 5 distinct behavioral components; takeoff, halfway flight, hovering to stimulus source, landing and egg-laying, were analyzed in wind tunnel tests. Host-plant odors accelerated takeoff, increased orientated hovering and landing, and sustained egg-laying, but never increased time per egg deposition. Non-host plant turnip odors never accelerated takeoff and simulated less egg-laying although other behavioral components were normally induced. These results indicate that suitable and continuous plant olfactory stimuli enhance host-finding efficiency stimulating the complete oviposition process both in terms of speed and accuracy, and stimulate more egg deposition after landing. Odors of an absolute non-host, potato tuber, never triggered any oviposition responses. A series of normal behavioral components were induced by continuous odor stimuli from host-plants. Host-plant odors led to longer time for egg-laying, but no decrease in the time for each egg. However, absence or elimination of host odors delayed takeoff and interrupted all subsequent behavioral components, including source orientation and egg deposition.

The headspace volatiles (HSVs) of 3 host and 3 non-host plant species were subjected to GC-EAD analysis. Twenty compounds in the HSVs evoked olfactory receptor potentials in female antennae of this nocturnal species, but less common GC-EAD active volatiles were found in different plants, suggesting an involvement of highly common chemical agent(s) such as $CO_2$ because of increased production by plants at night. Although oviposition stimulating activity of $CO_2$ itself was not confirmed, oviposition responses significantly decreased under a reduced $CO_2$ environment around an artificial substrate releasing natural simulative fruit odors, indicating that *C. punctiferalis* female moths can detect concentration gradients of $CO_2$ and use them and specific plant volatiles as cues for host-finding.

Results of this study indicate a new cutting edge method for integrated pest management (IPM) by push-pull strategies with kairomones as well as allomones. So far the development of control agents for herbivore pests has mainly focused on secondary plant metabolites, thus the utility of $CO_2$ and plant volatile(s) may break the limitations and encourage the development of a new type of insect behavior regulator (IBR) other than pheromones. Accordingly, the work of this thesis contributes to understanding the detailed modes of action of plant odor stimuli in host-plant selection by phytophagous insects, as well as for the developing new control agents or methods from not just host but also non-host plants by targeting particular behavioral components during the oviposition process in phytophagous insects.