Microbial volatile organic compounds from tempered and incubated grain mediate attraction by a primary but not secondary stored product insect pest in wheat

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Abstract

There has been a dearth of research elucidating the behavioral effect of microbially-produced volatile organic compounds on insects in postharvest agriculture. Demonstrating attraction to MVOC's by stored product insects would provide an additional source of unique behaviorally-relevant stimuli to protect postharvest commodities at food facilities. Here, we assessed the behavioral response of a primary (*Rhyzopertha dominica*) and secondary (*Tribolium castaneum*) grain pest to bouquets of volatiles produced by whole wheat that were untempered, or tempered to 12%, 15%, or 19% grain moisture and incubated for 9, 18, or 27 days. We hypothesized that MVOC's may be more important for the secondary feeder because they signal that otherwise unusable, intact grains have become susceptible by weakening of the bran. However, contrary to our expectations, we found that the primary feeder, *R. dominica*, but not *T. castaneum* was attracted to MVOC's in a wind tunnel experiment, and in a release-recapture assay using commercial traps baited with grain treatments. Increasing grain moisture resulted in elevated grain damage detected by near-infrared spectroscopy and resulted in small but significant differences in the blend of volatiles emitted by treatments detected by gas chromatography coupled with mass spectrometry (GC–MS). In sequencing the microbial community on the grain, we found a diversity of fungi, suggesting that an assemblage was responsible for emissions. We conclude that *R. dominica* is attracted to a broader suite of MVOC's than *T. castaneum*, and that our work highlights the importance of understanding insect-microbe interactions in the postharvest agricultural supply chain.