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RESPIRATORY RESPONSE OF INSECTS TO CONTROLLED ATMOSPHERES AND FUMIGANTS

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Immature stages of insects show tolerance to fumigants including phosphine, ethyl formate, sulfuryl fluoride and controlled atmospheres. The mechanisms of tolerance are not well understood but uncovering them could lead to faster or improved fumigations. To investigate the effects of fumigants on respiration, a major route of uptake, we have measured respiratory output from individual insects at regulated temperature, using a sensitive, flow-through CO_2 and water analyser coupled with an O_2 probe. The respiratory response of *Tenebrio molitor* larvae exposed to reduced O_2 for 10 min, then returned to air, was measured. In 10, 5 and 2% atmospheres the normal ventilation patterns of the larvae were completely disrupted although the output of CO_2 was maintained; this pattern suggests the larval ventilation rate had been greatly increased and the spiracles remained open during hypoxia. When the larvae were returned to normoxia, CO_2 release was significantly depressed in the larvae exposed to 5 and 2% O_2 and recovery was slow. In contrast, the respiration in *Sitophilus oryzae* larvae was strongly suppressed during 1 h exposure to anoxia but had recovered to normal respiratory ventilation within 10 min of returning to air. These results demonstrate the potential of this approach to investigate the role of respiration in fumigant tolerance.