PS 47-170: Analyzing the movement of an invasive weevil (*Polydrusus sericeus*) using stable isotopes

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Background/Question/Methods

To better understand the response of insect populations to increasing CO\(_2\) and O\(_3\), we used ratios of stable carbon isotopes (d\(^{13}\)C) to trace the movement of an invasive insect in mixed tree communities grown under different air quality conditions. *Polydrusus sericeus* is a non-native weevil commonly found in the northern hardwood forests of Wisconsin and Michigan, USA. The weevil feeds primarily on fine roots (larvae) and leaf margins (adults) of hardwood tree species. Since 1998, young communities of trembling aspen, paper birch, and sugar maple were grown under elevated CO\(_2\) and O\(_3\) at the Aspen Free-Air Carbon Dioxide Enrichment (FACE) Experiment, Harshaw, WI. Twelve experimental rings of trees were fumigated throughout the growing season with elevated CO\(_2\) (560 ul l\(^{-1}\)), elevated O\(_3\) (80 nl l\(^{-1}\)), elevated CO\(_2\) and O\(_3\), or no treatment. The source CO\(_2\) used for treatment is derived from fossil fuel and is highly depleted in \(^{13}\)C. Because d\(^{13}\)C values in animal tissues are largely reflected by the values in their diet, we used the fumigation CO\(_2\) as a tracer to determine the source populations of *P. sericeus*. Sixty weevils were sampled per treatment ring for stable isotope analysis with an elemental analyzer.

Results/Conclusions

One-way ANOVAs examined treatment effects in the isotopic signatures of *P. sericeus* individuals. Differences in d\(^{13}\)C values are highly significant (P < 0.0001) between weevils collected from elevated CO\(_2\) treatments (mean \(\pm\) se = -35.2 \(\pm\) 0.15‰) and ambient CO\(_2\) treatments (-26.5 \(\pm\) 0.15‰). Sample distributions of individual d\(^{13}\)C values were examined using Box-and-Whisker plots to identify extreme values. The d\(^ {13}\)C values are normally distributed in control ring 3.1 with a mean of -26.1‰ (SD = 0.9) and a minimum value of -28.3‰. Therefore, we considered any individual with a d\(^{13}\)C value less than -27.9‰ (mean \(\pm\) 2SD) to be marked with the \(^{13}\)C tracer. Although the majority of weevils have isotopic signatures consistent with their ring of origin, we detected migrant individuals (6.7%) in 9 of 12 treatment rings, suggesting a minimum range of dispersal distance from 128 to 242 meters. Moreover, the elemental C to N ratio (C : N) is significantly increased above the control for weevils sampled from the elevated O\(_3\) plots (p < 0.03), implying potential changes in food quality related to treatment.

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