

Tuesday, August 3, 2010

SKIP  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 CO₂ and O₃, we used ratios of stable carbon isotopes (δ¹³C) 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 CO₂ and O₃ 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 CO₂ (560 μl l⁻¹), elevated O₃ (80 nl l⁻¹), elevated CO₂ and O₃, or no treatment. The source CO₂ used for treatment is derived from fossil fuel and is highly depleted in ¹³C. Because δ¹³C values in animal tissues are largely reflected by the values in their diet, we used the fumigation CO₂ 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 δ¹³C values are highly significant (P < 0.0001) between weevils collected from elevated CO₂ treatments (mean ± se = -35.2 ± 0.15‰) and ambient CO₂ treatments (-26.5 ± 0.15‰). Sample distributions of individual δ¹³C values were examined using Box-and-Whisker plots to identify extreme values. The δ¹³C 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 δ¹³C value less than -27.9‰ (mean ± 2SD) to be marked with the ¹³C 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 O₃ plots (p < 0.03), implying potential changes in food quality related to treatment.

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