

Interannual variation in moth population's body size and possible links to foliar nutritional quality

Margi Dashevsky '10

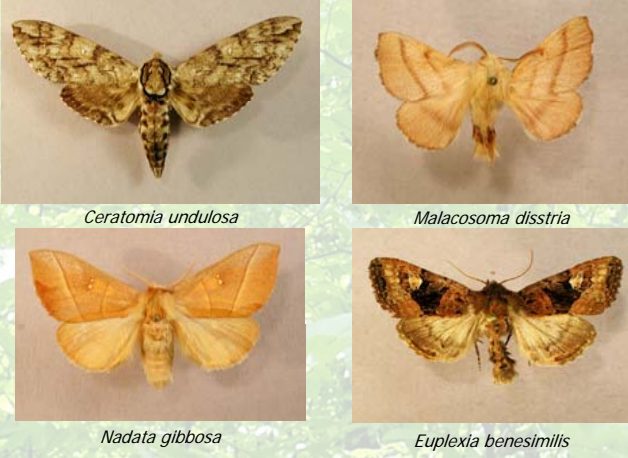
Advisors: Erik Stange and Matt Ayres, Department of Biological Sciences, Dartmouth College

Background

- Lepidoptera (caterpillar and moth) communities in the northern hardwood forests of Hubbard Brook and Moosilauke are highly dynamic, interannually varying 22-fold in abundance and 52-fold in biomass [1]
- These community dynamics exhibit regional (400 km²) synchrony [2] and are correlated with global climate patterns (i.e. El Niño events) [3]
- Changes in temperature could affect nutritional value of caterpillar host plants by influencing soil microbial activity
- Hundreds of caterpillars species share limited host plant species which causes moth populations to experience similar nutritional variation, which leads us to question:

Do moth body sizes vary between years, suggesting foliage nutritional quality influences their population dynamics?

Reynolds, L. V., M. P. Ayres, T. G. Siccama, and R. T. Holmes. In press. Climatic effects on caterpillar fluctuations in northern hardwood forests. Canadian Journal of Forest Research. Jones, J., P. J. Doran, and R. T. Holmes. 2003. Climate and Food Synchronize Regional Forest Bird Abundances. Ecology 84:3024-3032. Sillett, T. S., R. T. Holmes, and T. W. Sherry. 2000. Impacts of a global climate cycle on population dynamics of a migratory songbird. Science 288:2040-2042.



Measuring forewing length using digital calipers

Sex and variation in body size

Black light traps used to sample moth populations capture more males than females.

Question 1: Do male and female moths' body size vary differently?

I measured forewing, head capsule, and thorax of male and female specimens of 14 species. Female moth body size varied slightly more in all but 3 species, yet these variations were not significant (lowest P = 0.12).

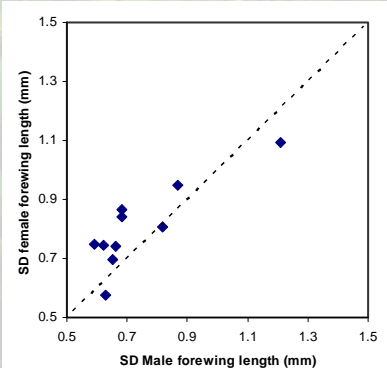


Fig. 1. Standard deviation of male and female body size in 14 species, plotted against a 1:1 line. Overall female body size varied significantly more (T = 2.31, P = 0.04).

Interannual variation in body size

Because we did not find significantly greater variation in female moth body size within each species, we can test for interannual variation using only males.

Question 2: Do moth body sizes vary between years?

We selected four taxonomically diverse yet ecologically similar species and measured forewing length of randomly selected male specimens captured in years 2004, 2005, and 2006. We found no significant differences in body size between years (F_{2, 313} = 1.60, P = 0.20), nor was there a significant interaction between species and year (F_{6, 313} = 1.22, P = 0.30). When analyzed separately only *Nadata gibbosa* exhibited significant interannual variation in body size (F_{2, 76} = 3.43, P = 0.04).

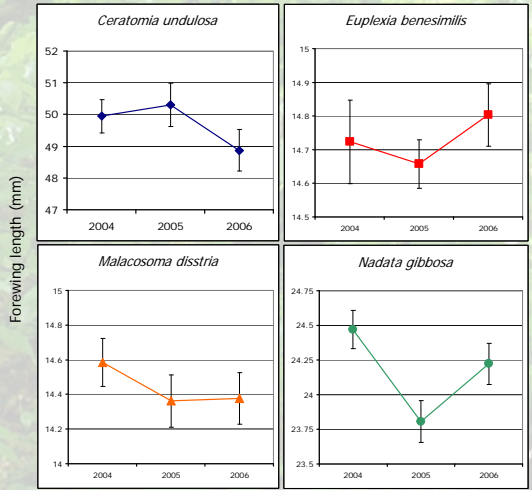


Fig. 2. Mean male forewing length (mm) of four Lepidoptera species. Error bars = ± 1SE.

Discussion

These results do not support the hypothesis that changes in nutrient availability produce variations in moth body size. That said, these four species may not accurately represent the entire community, and interannual variations in nutritional quality may be reflected in other variables, such as length of caterpillar feeding stage. Additionally, climate may impact caterpillar communities in other ways including variable growth rates, dependant on temperature's affect on metabolic rates, varying winter survival, etc. predation and levels of parasitism.