



Can the nutrient dynamics of a northern hardwood forest explain variation in its trophic structure?

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Trophic structure for some communities is relatively stable:

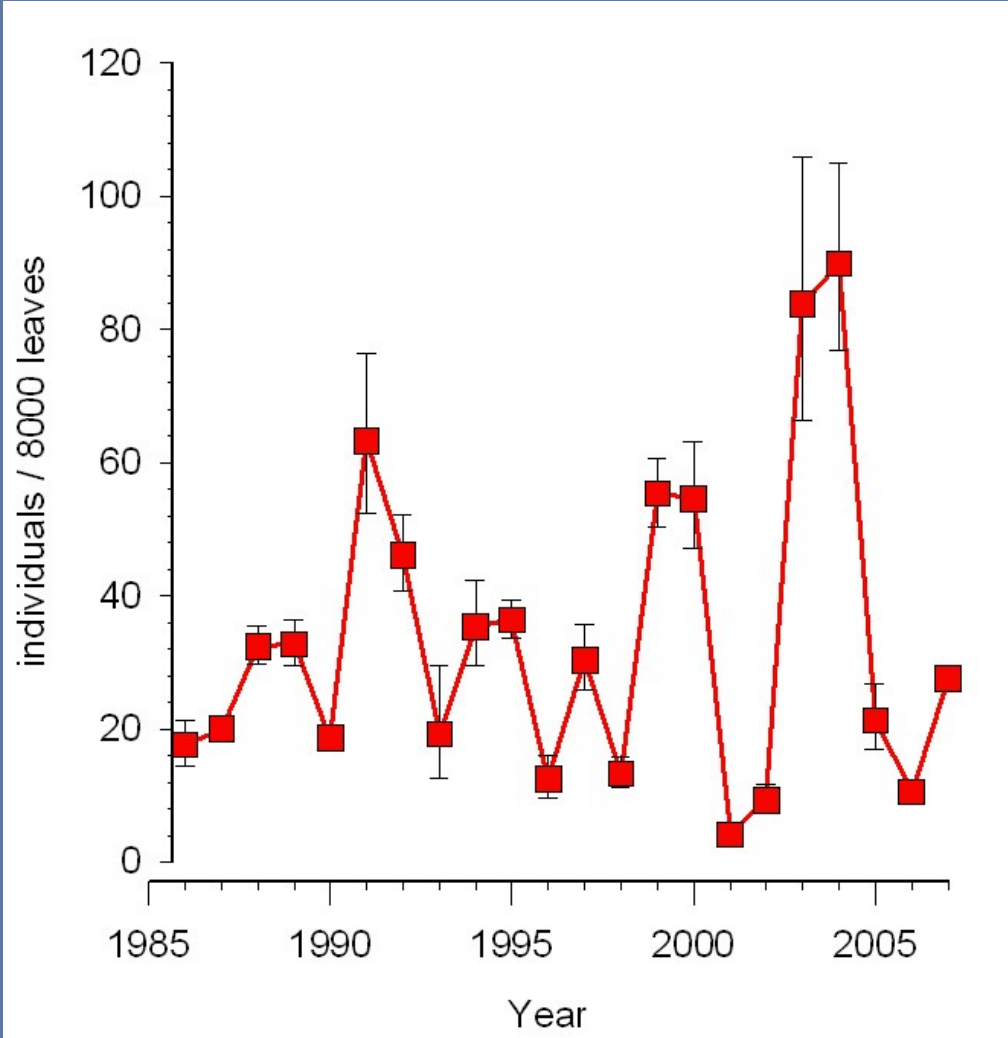


While the temporal variation in trophic structure for other communities is quite high:



Factors influencing trophic structure stability:

- Variability of the physical environment and plant productivity
- Consumer community diversity and proportion of trophic generalists
- Extent of interspecific competition and compensatory dynamics

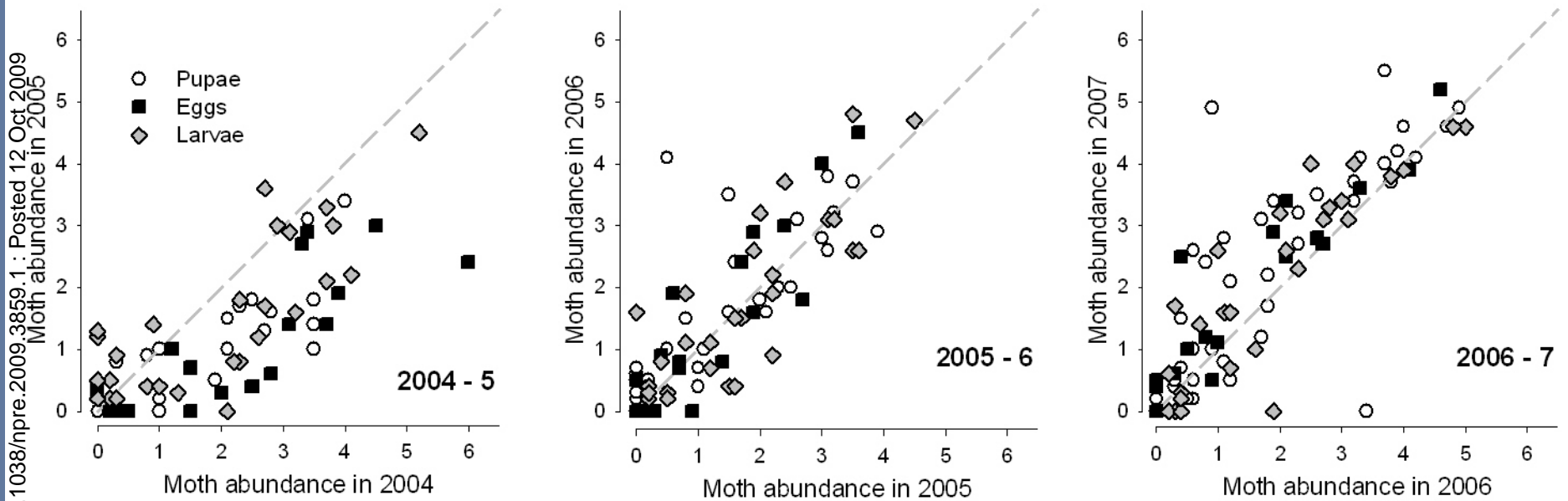


Reynolds *et al.* 2007 CJFR
Holmes *et al.* unpublished data

Extreme temporal variance in Lepidoptera abundance is not uncommon:



Abundance units: $\text{Ln}(\text{ind} \cdot \text{trap}^{-1} \cdot \text{yr}^1)$



- 2004 - 2005: 58 of 89 species had negative growth rates
- 2006 - 2007: 69 of 115 species had negative growth rates







H: Interannual variation in nutrient availability drives
Lepidoptera community dynamics

3. Does soil mineral nutrient content vary
interannually?

YES

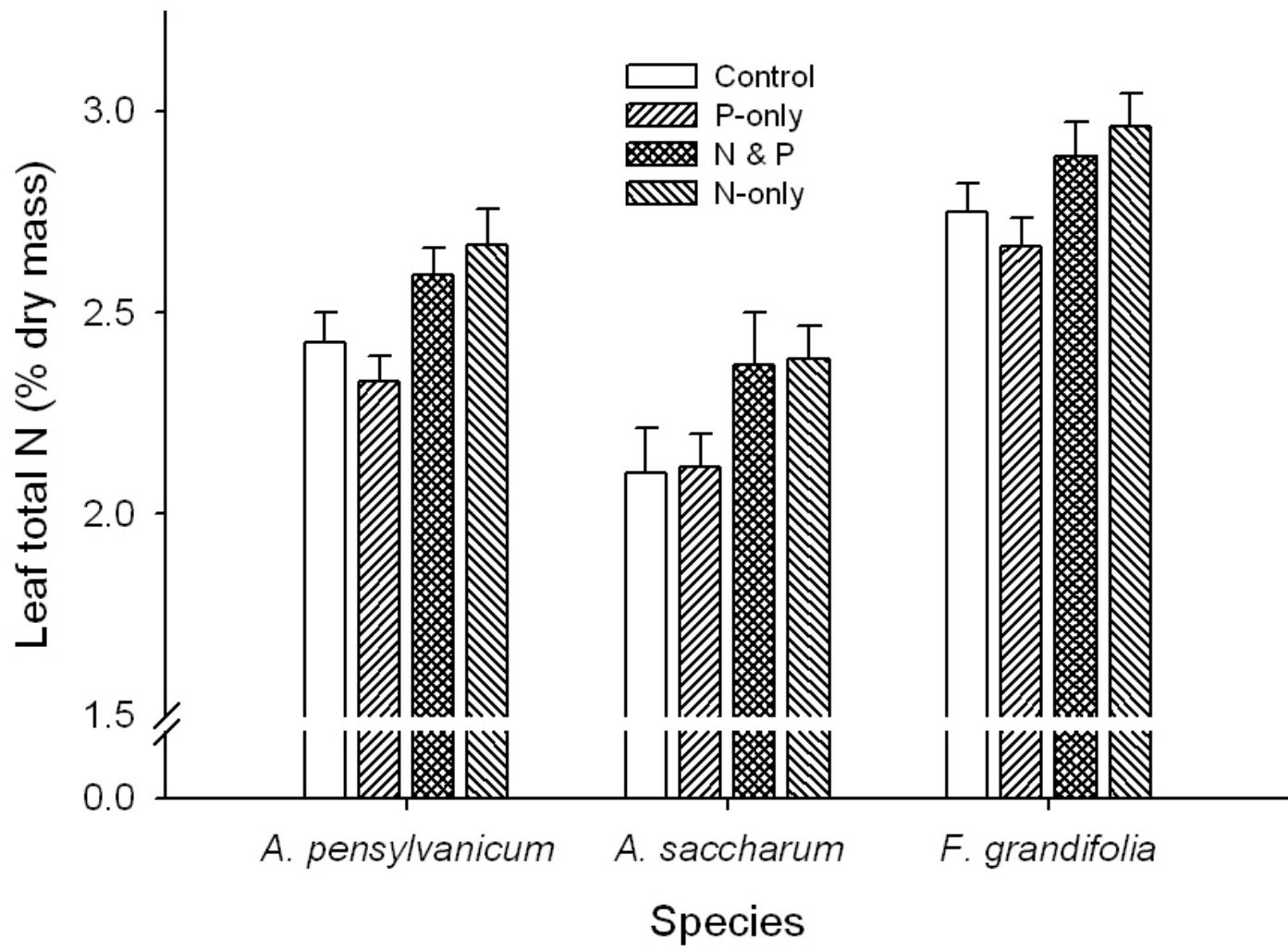
Resin bag test for NH_4^+ , $\text{NO}_3^- / \text{NO}_2^-$ and PO_4^{3-}

2. Does soil mineral nutrient concentration affect
foliar chemistry?

Fertilizer experiment (N, P)

2004: 25 g N m^{-2} and 8 g P m^{-2}

2005: 8 g N m^{-2} and 2.5 g P m^{-2}





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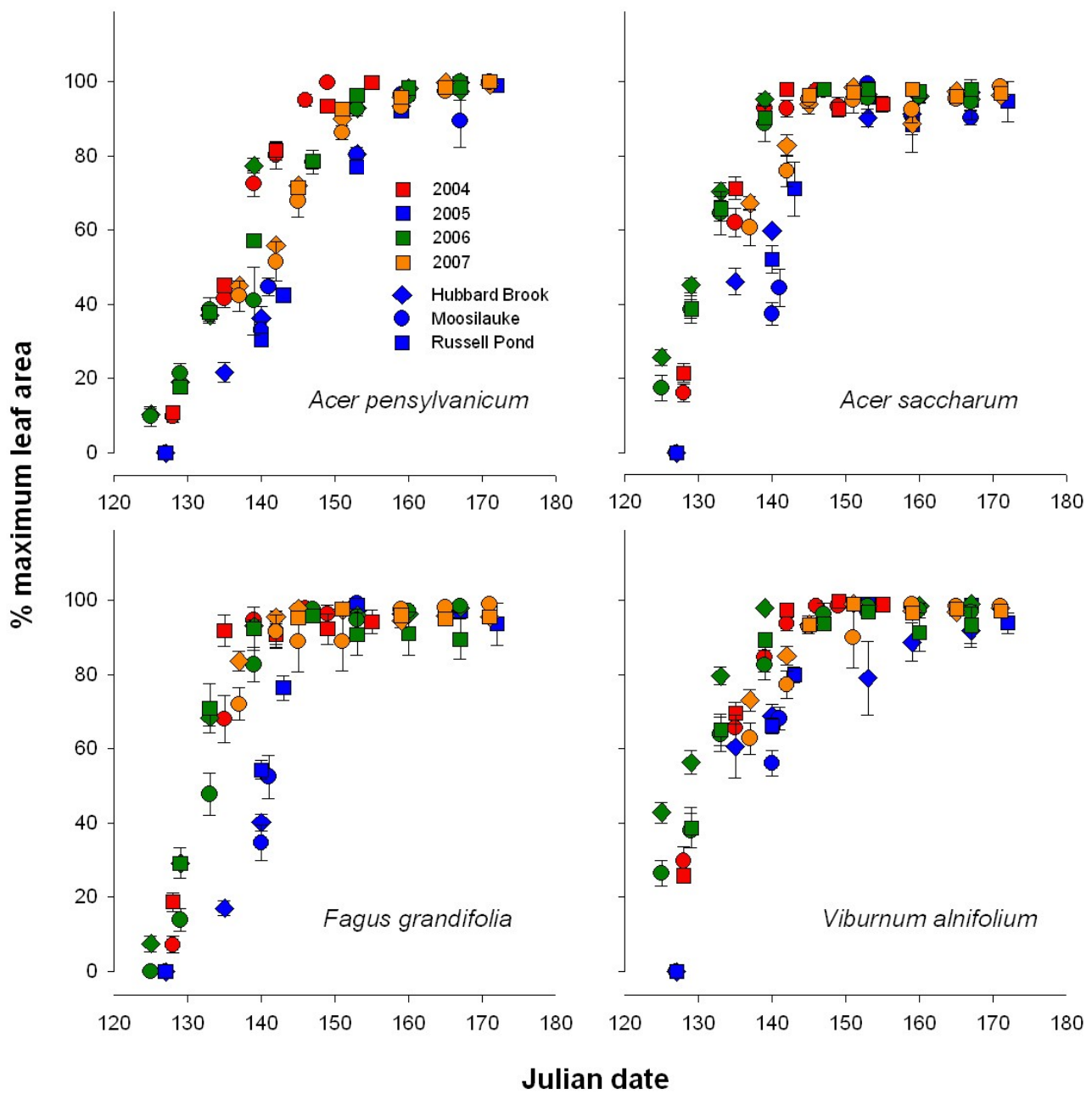
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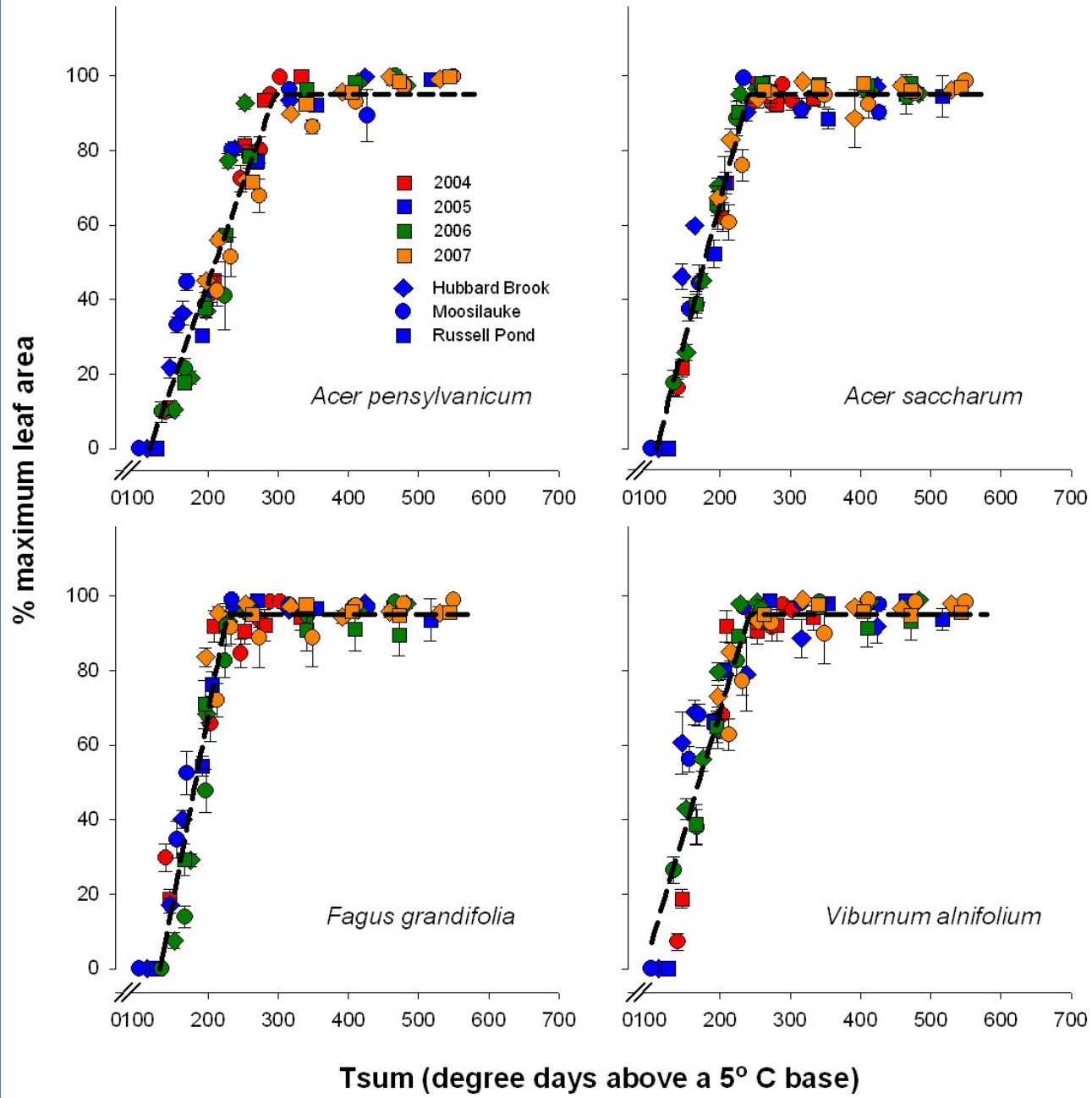
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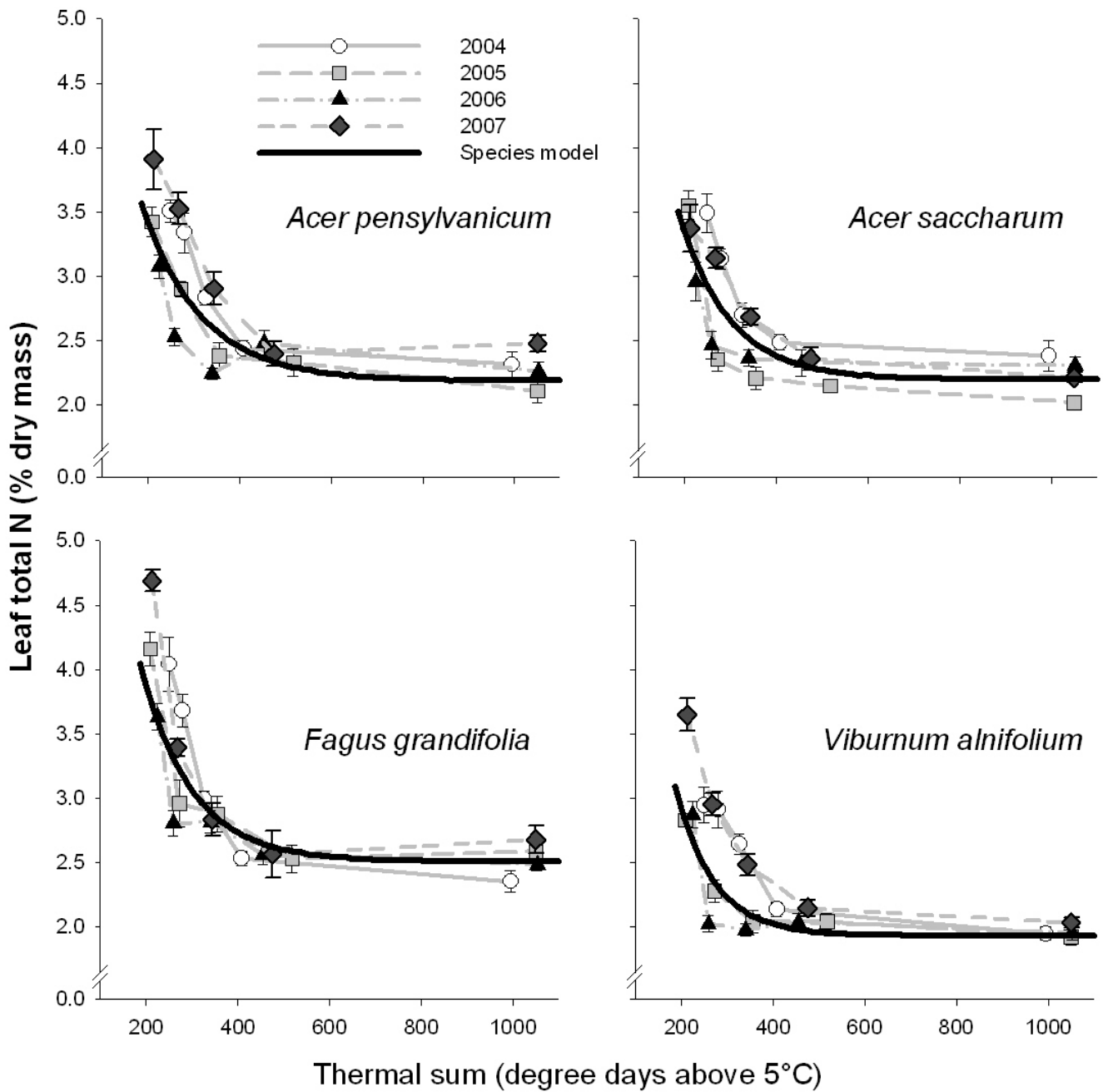
Well-known pattern of decreasing %N during leaf expansion

Leaf expansion tends to be sensitive to temperature









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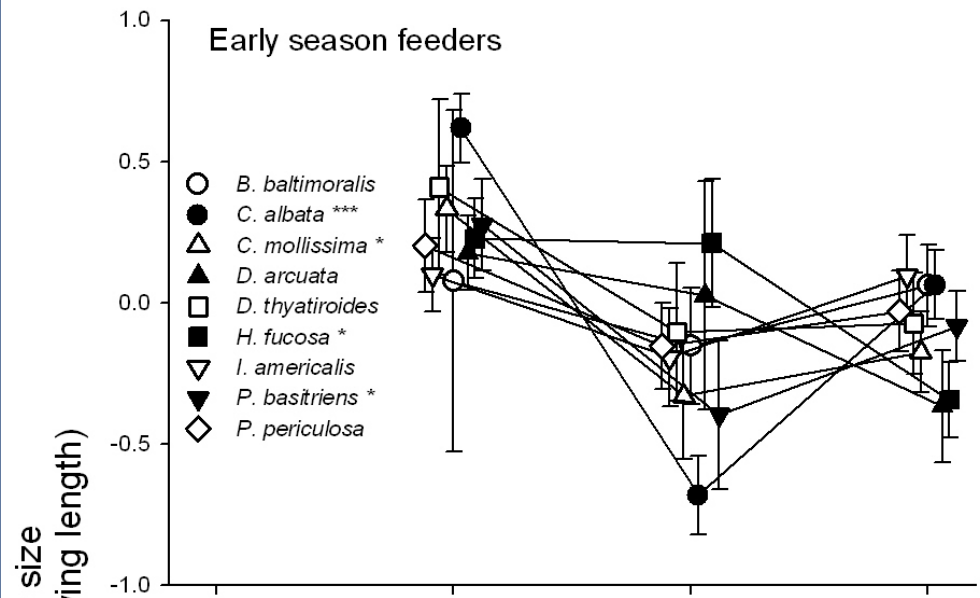
3. Does variation in foliar quality matter to Lepidoptera growth?

Test for interannual variation in Lepidoptera growth performance:

16 species of free flying moths:

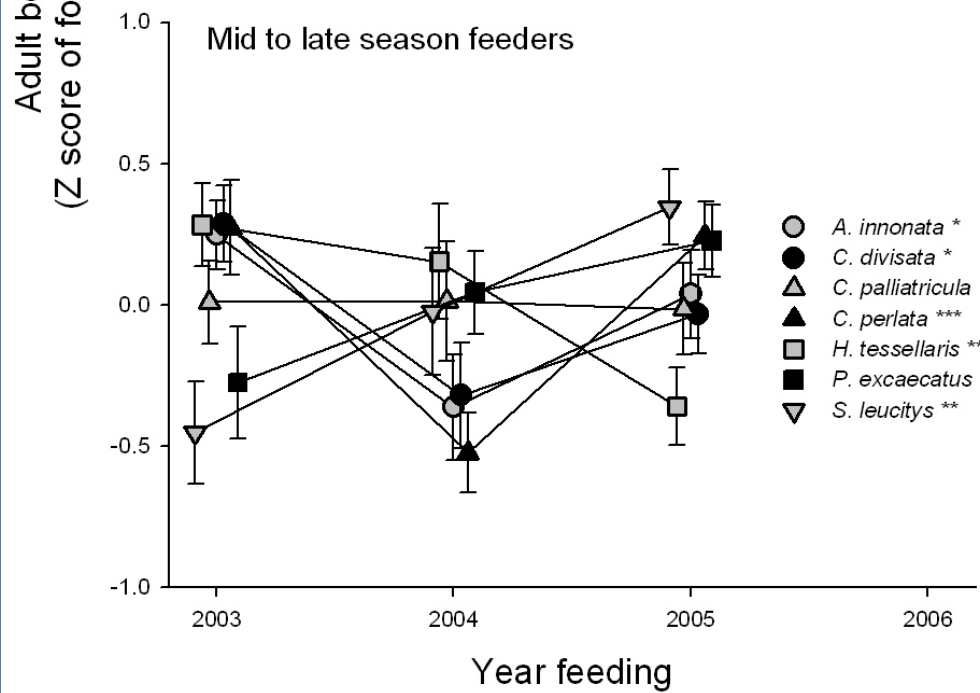
- 9 feeding in early season
(May to mid-June)
- 7 mid to late season feeders





4. Does variation in foliar quality matter to Lepidoptera growth?

YES



5. Does Lepidoptera growth matter to community abundance?

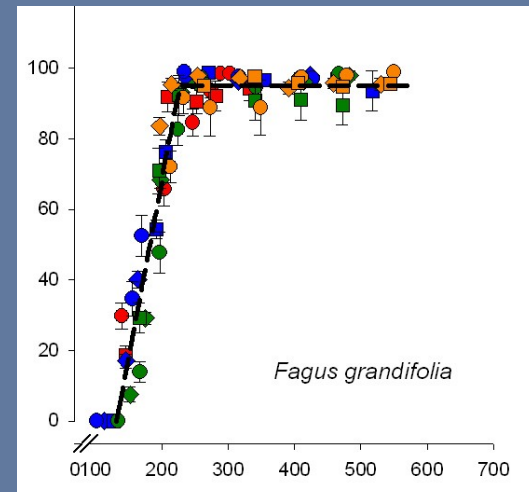
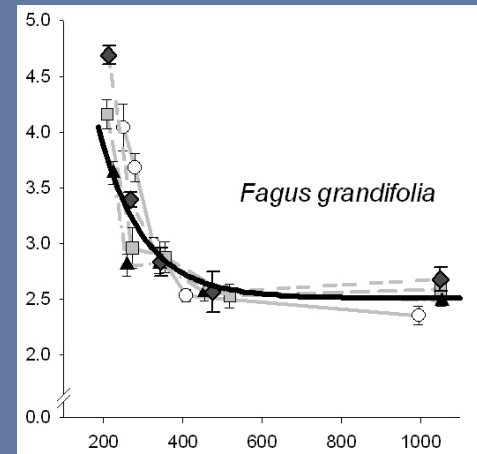
YES

Phenological Race Hypothesis:

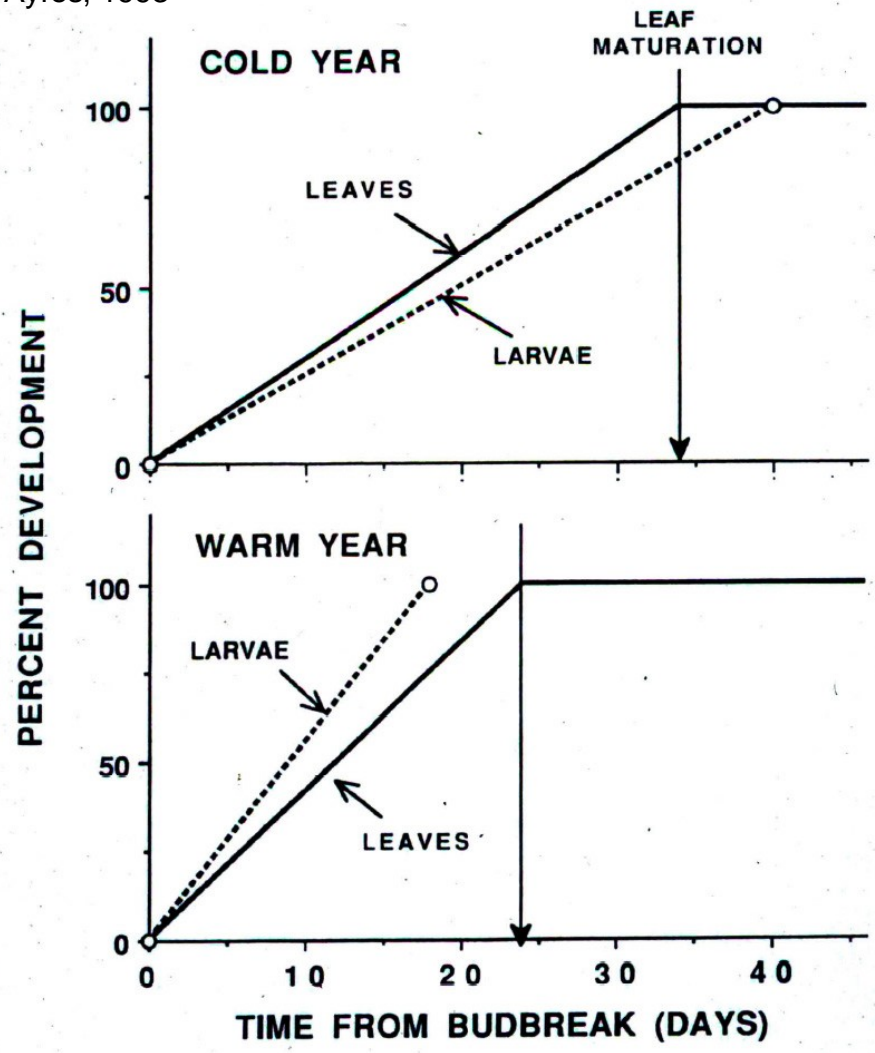
Nutritional suitability for herbivores declines as leaf matures

Rate of leaf maturation is temperature dependent

Insect consumption rate, metabolic rate and potential growth rate all increase with temperature



Ayres, 1993



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