Leaf Ontogeny and Variation in the Phenology of Different Plant Species May Help Explain the Life History Traits of Specialist Insects

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Background:

Leaves change structurally and in quality for herbivores as they develop (leaf ontogeny). Plants vary in timing of leaf production, ranging from determinate (like oak trees) with a short burst of high-quality leaves per season, to indeterminate (like eastern cottonwood) which produce high quality leaves throughout the season (Figure 1).

Hypothesis:

Because specialist herbivorous insects exhibit preference for leaves approaching full expansion, we hypothesize that leaf ontogeny together with plant phenology play significant roles in shaping insect life history traits, such as the number of generations per year and frequency of outbreaks.

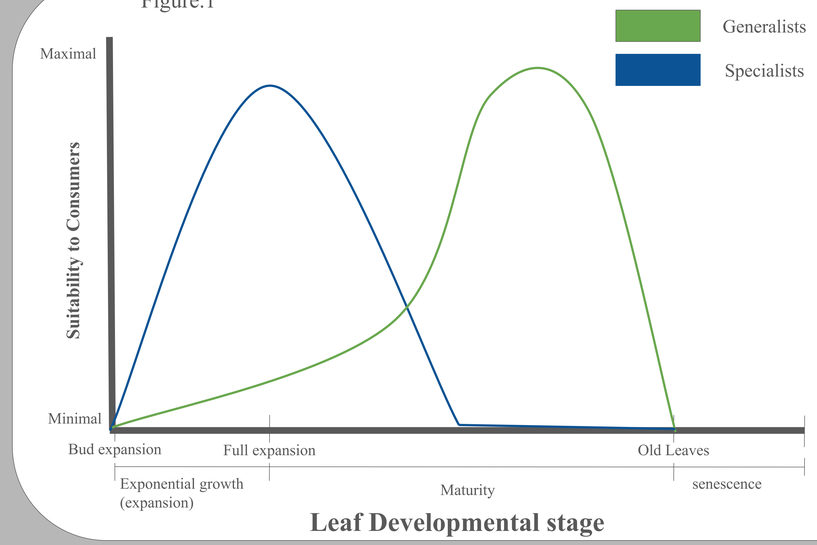
Summary:

A literature analysis of 36/6 papers was conducted linking insect preferences for leaves as they age, the phenology of leaf production, and various life history traits of herbivorous insects. We examined 13/2 determinate plant species and 21/4 indeterminate plant species. Our findings support the following:

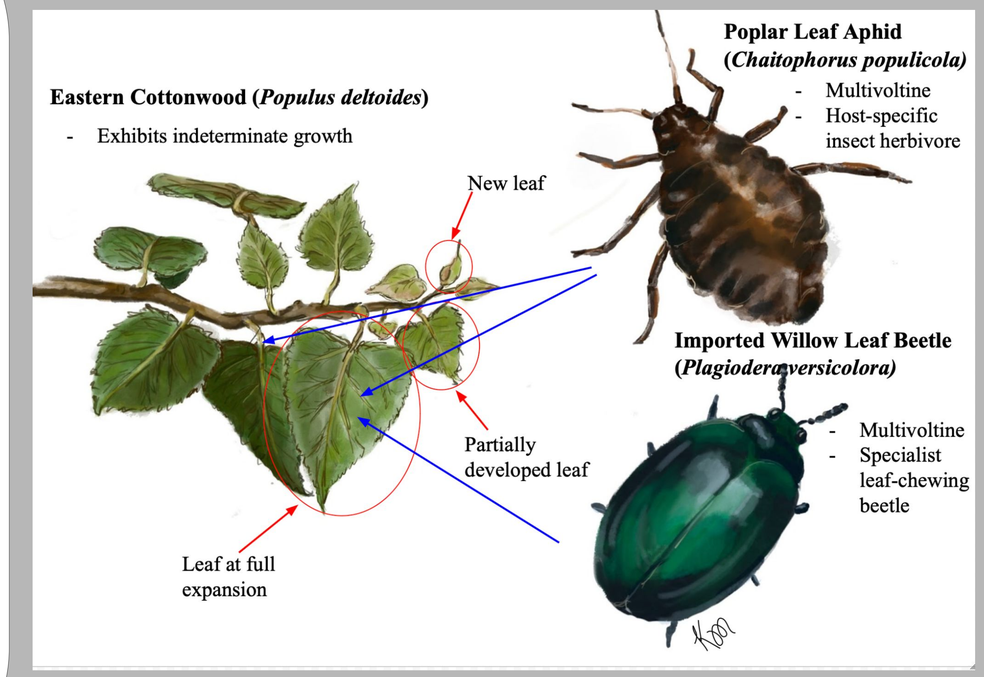
- Insects can detect changes in leaf quality and show preference for leaves at or approaching full expansion. These leaves are often high in nutrients and secondary metabolites that specialist herbivores can utilize or digest. This also underscores the importance of leaf developmental stage over chronological age when referring to leaf suitability.

- Specialists depend on the ability to track plant growth patterns, this allows for the production of offspring when there are the most high quality resources available. Multivoltine specialists align the start of their reproductive season with the start of constitutive leaf production in indeterminate plants. Univoltine species must also align reproduction with a time at which resources are plentiful, although they are able to utilize the single flush of leaves produced by determinate plants at the start of the growing season.

Figure.1



A graphical representation of the relative amount of available high-quality leaves on determinate and indeterminate plants.



Leaves of the eastern cottonwood tree are preferred by insect herbivores at full expansion.