Flower and Tongue Length, evidence of co-evolution, or just another pollinator syndrome?
Annotated Bibliography
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Fall ‘02
Plant Animal Interactions

Visits to Viola based on corolla length and proboscis length. Fantastic diagrams of bee visits. Findings: Longer proboscis=better pollination per visit. Discusses pollination of several insects and the breakdown of the bee flower pollination syndrome.

Information on evolution of floral traits based on influence of pollinator traits.

More information on which moths do what pollination in North America rather than good information on proboscis length relationships or pollination efficacy.

Good anecdotal information on hawkmoth pollination. Purely an observational study with no statistical tests, etc.

Very interesting study. Developed models and equations to test how well morphological characters predicted flower choice in bumblebees. Found that bumblebees with short tongues were more predictable than bumblebees with long tongues because of restricted resource availability.

Another interesting study. This is by the man that wrote Bumblebee Economics. Measures resources available and resources used and finds that in his system resources are limiting. Good information on theory behind specialists vs. generalists and where we would expect to find each.

Good information on lepidoptera pollination. Makes some interesting inferences that I'm not sure he backs up about butterfly tongue length. Here he says that body size is more important that tongue length b/c large body
size=long tongue. This paper is about more than leps though and investigates which is more important, quality or quantity. He also has a quality paper out, but I didn’t read it. He makes some comparisons in the discussion.


Discusses pollination efficacy of 3 bombus spp. Also talks about pollen limitation and how this affects community dynamics. Finds evidence for changing flower morphology across landscapes due to bumblebee spp.


Paper we read for class: Interesting experimental comparisons of bumblebee resource use. Neat manipulative study with interesting results on resource partitioning. This along with his dissertation from North Carolina started the debate with Ranta on competition vs. environmental variation.


Good overview of how bumblebees use their tongues to obtain nectar from flowers. Also a good overview of what resource partitioning is and how it plays into community dynamics. Findings include the fact that long tongue bees forage faster on long corolla tube flowers and that short tongue bees prefer short corolla tube flowers. This papers supports his 78 paper.


This is one of the neatest papers that I read for this presentation. Great data on evolution of plant and animal traits together. Probably the most clear example of if not coevolution, at least the evolution of one species to the resources that are available to it.


Cynical quotes on pollinator syndromes! Good overview of specialization vs. generalization and in what circumstance we would expect each. Provides little evidence to support theory, but the paper is a good general overview.


Talks about how many pollinator syndromes collapse under testing in this system. Tests many different morphology traits and finds that tongue length was one of the only traits of animal pollinators to correlate with floral traits. Also found a relatively high degree of specialization in this system.


Compares flower visiting nymphalid butterflies to non-flower visiting nymphalid butterflies. Finds that flower visiting species have shorter
proboscides than non-flower visiting. Interesting comparison of 60 different nymphalid butterflies in all physical and behavioral traits.


Discusses an obligate pollination relationship between Pedicularis and Bombus. Found a high degree of plant fidelity throughout blooming period by Bombus. Compares Pedicularis of different corolla tube lengths and corresponding visits by bumblebees. Uses a different method to test resource partitioning (Queen visits/Worker visits x # spp.) than Ranta or Inouye but results support Ranta's theory. Not sure that this method is really set up to test this theory and the author may have overreached his data.


Another great paper on fly pollination. Very interesting study and neat results.


Compares 2 butterfly species for lipid reserves throughout different life stages. Shows that butterflies with longer proboscides can more easily find better resources during adult phase. Wasn't able to tie this to fecundity, but realized the need to do so.


Very cool manipulative study in Alaska. Shows results that bumblebees rob nectar, but also pollinate the flowers during a different stage. Neat example of the need to observe things throughout the life-cycle and to not have blinders on as to results. At first glance it appeared that nectar robbing was the only thing happening.


Good overview paper in nature. Interesting discussion of the need for long-tongued pollinators and the potential problems that could arise if they start to disappear. Author feels that this study affirms Darwin's theory of coevolution of floral traits with pollinator traits.


Good review of morphology of birds and function. Not too much on tongue length, nor anything on pollination efficacy of different traits or morphologies. Interesting info for bird enthusiasts, but not much scientific value.


Shows that proboscis length in moths is not correlated to pollination efficacy and that moth pollinated plants must depend on multiple visits from moths.
*Talking about mechanisms for extinction in bumblebees.* Evidence that plants with longer corolla tubes produce more nectar. For the most part this is a qualitative paper with some neat ideas and interesting discussion regarding competition theory.

*Discussing "specialization" of long-tongue bumblebees.* For the most part this is a community ecology paper on resource partitioning. Interesting theory and some evidence to back it up.

*Neat comparison of the resources available to the resources used by bumblebees.* Used mathematics to come up with expected patterns of resource use based on proboscis length and competition theory to compare them to observed results. Results deviate from what would be expected under competition theory and support the uneven availability of resources throughout the season. Good read.

*Paper we read for class that compares resource use in two communities and makes conclusions on resource partitioning.* Finds that in communities with predictable resources bumblebees will separate via competition theory, but when resources are unpredictable bumblebees will not separate out by tongue length.

*More information on tongue length and # of species.* I feel that the evidence presented in this paper does not support his findings. The scale is too large and the species he says coexist are living several kilometers from each other. Tried to use this paper to disprove Inouye's theory, but didn't do such a good job.

*Very neat study.* “Not only did floral morphology differ between sites, but the direction of the differences was consistent with the hypothesis that floral traits are adapted to the local pollinators in each site. Good evidence that butterflies are indeed pollinators!