Temporal dynamics of a plant-pollinator network in a warming Arctic

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INTRODUCTION

Plant-pollinator interactions

- Plant-pollinator interactions are among the most ecologically important interactions in nature.
- The timing between the plants and the pollinators are crucial for the functioning of the interaction.

Climate change

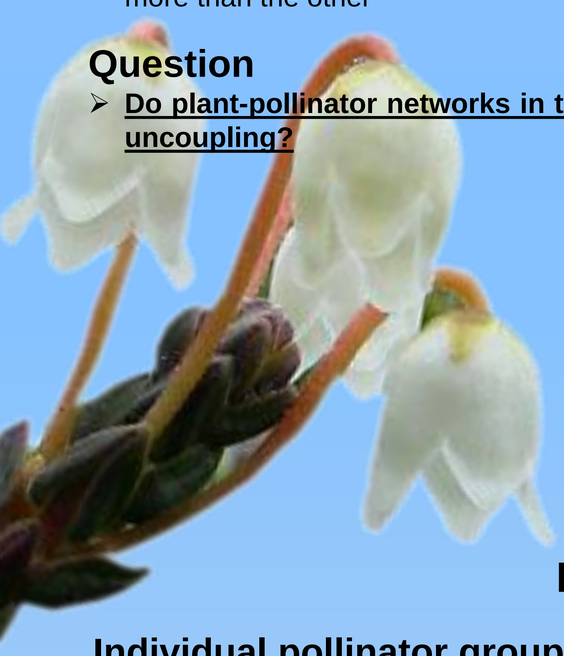
- Climate change alters phenologies both plants and pollinators
- Phenological advancement is more pronounced in the Arctic.

Concern

- Concern about temporal uncoupling of trophic interactions if one partner advances more than the other

Question

- **Do plant-pollinator networks in the high arctic experience temporal phenological uncoupling?**



METHODS

Where?

- Zackenberg Research Station, Northeast Greenland (74°28'N, 20°34'W)

What?

- Phenological data on 6 plant species and 13 pollinator groups during 16 years.

How?

- Using information on timing (DOY for flowering/emergence), and corrected for abundance, visitation rates, and pollen carrying capacities we defined:

- Community Flowering Phenology (CFP) – when 50% of the buds in the flower community had opened.
  - Taking network connectance and pollen carrying capacity of pollinator into account

- Community Arthropod Emergence (CAE) – when 50% of the pollinator community had emerged.
  - Taking pollinator abundance, network connectance and pollen carrying capacity into account.

RESULTS

Individual pollinator groups

- All individual pollinator groups changed their temporal match with their flower community (figure 1A).
- Large temporal differences between different pollinator groups (figure 1A).

- Conclusion: Alarming – could indicate a temporal uncoupling of the plant-pollinator network

Community level

- Both the plant (CFP) and the pollinator (CAE) community exhibited a similar, negative temporal trend (- 6 days/decade, figure 1B)
- There was no difference in the slope between plants and pollinators.
- The phenology of CFP and CAE significantly associated with timing of snowmelt and the summer temperature.
- Again, both groups exhibited similar responses to the climatic variables.

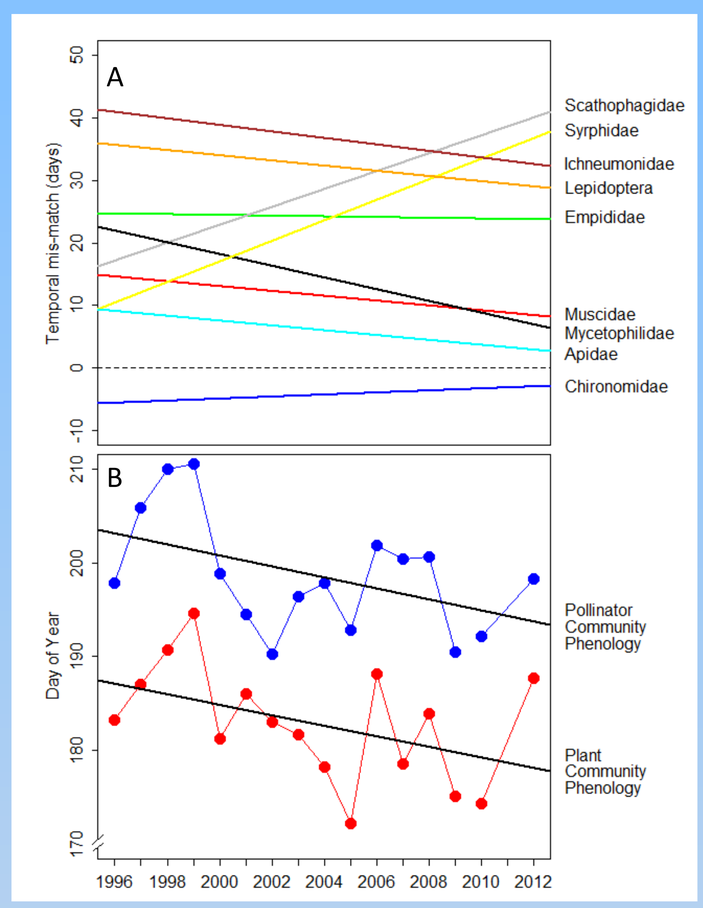


Figure 1: A) The phenological trends of the individual pollinator groups compared to their individual plant community. B) The phenological trends at the community level. 2010 data were lost during transportation.

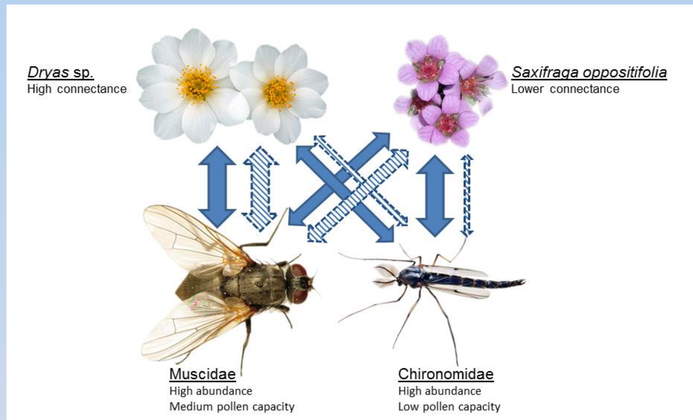
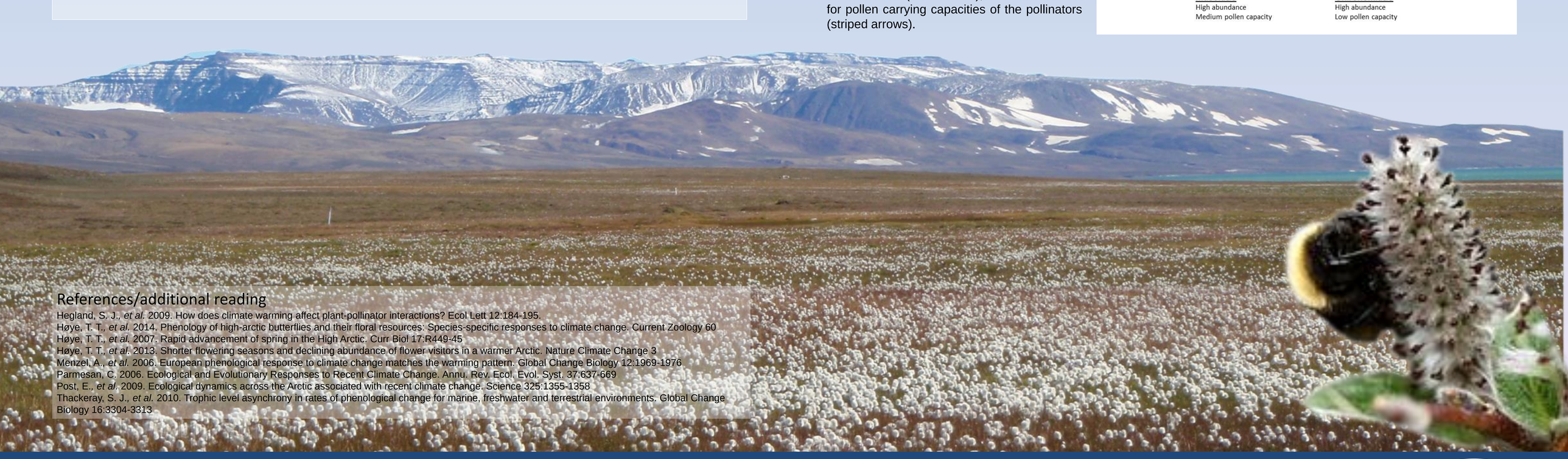


Figure 2: Relative illustration to demonstrate the community measures used in the study. The community measures take network connectance and abundances into consideration (blue arrows), and later correct for pollen carrying capacities of the pollinators (striped arrows).

CONCLUSION

- The temporal match between plants and pollinators at the community level remained stable during our study period of 16 years.
- The strong responses and the large variability between the different pollinator groups illustrate how easily the interactions may be disrupted, yet still remain functional at the community level.
- Our results thus indicate that this high arctic plant-pollinator interaction is highly resistant towards environmental fluctuations.



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