



Sunflower pollen defends bees against parasites



NC STATE UNIVERSITY

Jonathan J. Giacomini¹, Lynn S. Adler², Scott McArt³, David R. Tarpy⁴, Evan C. Palmer-Young² and Rebecca E. Irwin¹

(1) Dept. of Applied Ecology, North Carolina State University, (2) Dept. of Biology, University of Massachusetts Amherst, (3) Dept. of Entomology, Cornell University, (4) Dept. of Entomology, North Carolina State University

Background

- Parasites may be partially responsible for recent bee population declines.
- Pollen may play critical but largely unrecognized role in mediating bee-pathogen dynamics.

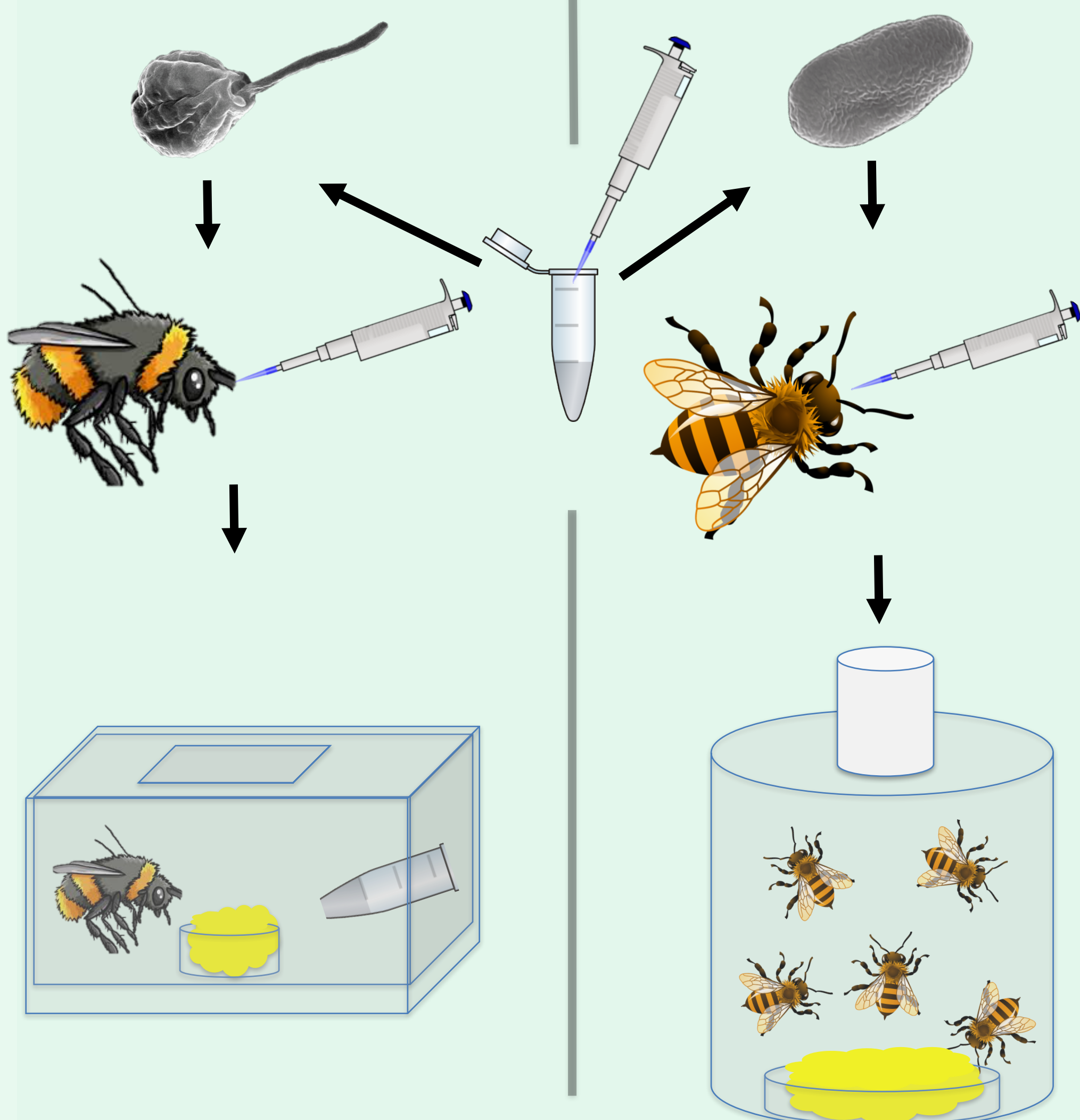
Question

- How do pollen species vary in their effects on bee parasites?

Experimental methods

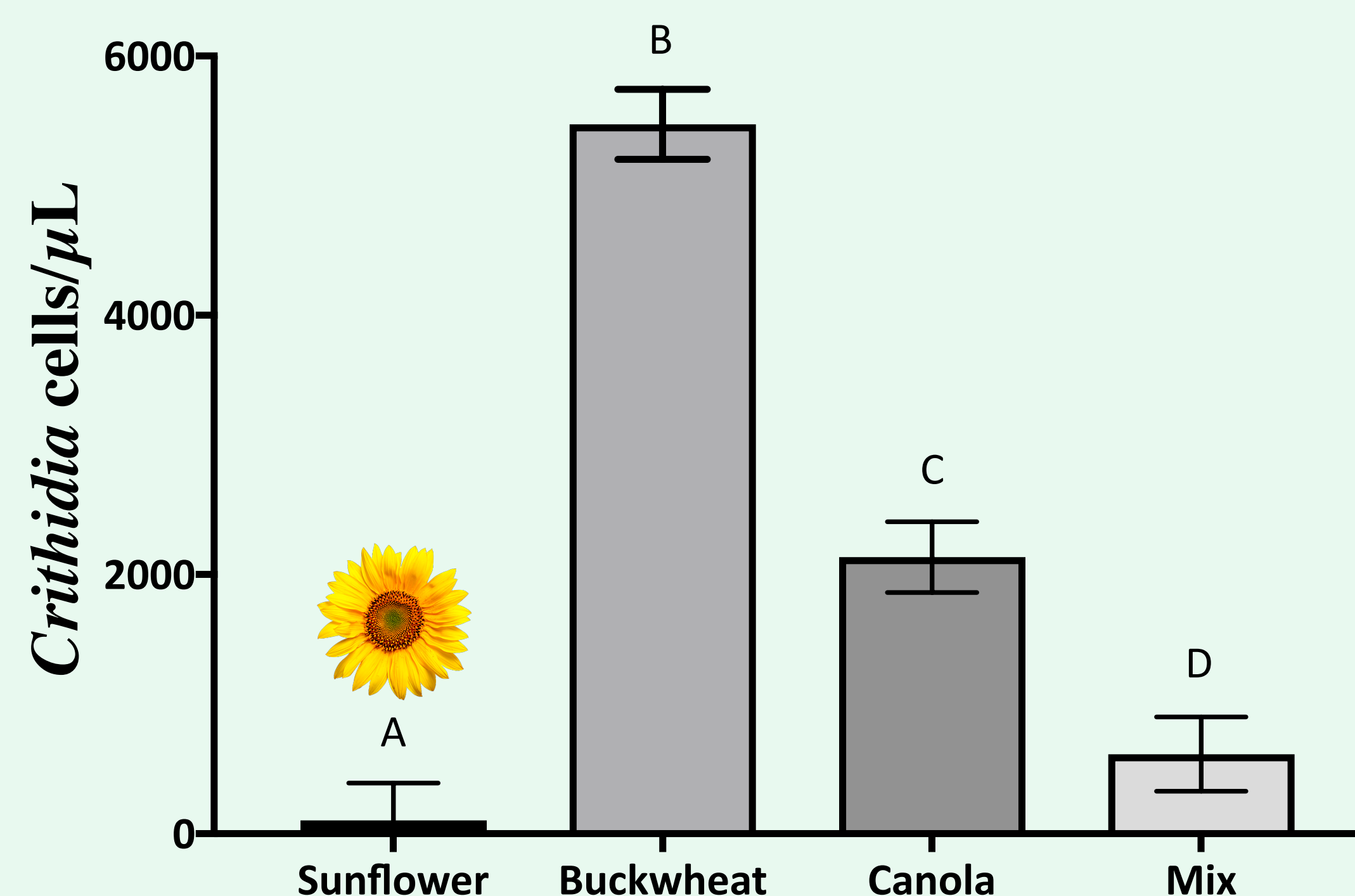
Bombus impatiens workers inoculated with *C. bombi*.

Apis mellifera workers inoculated with *N. ceranae*.

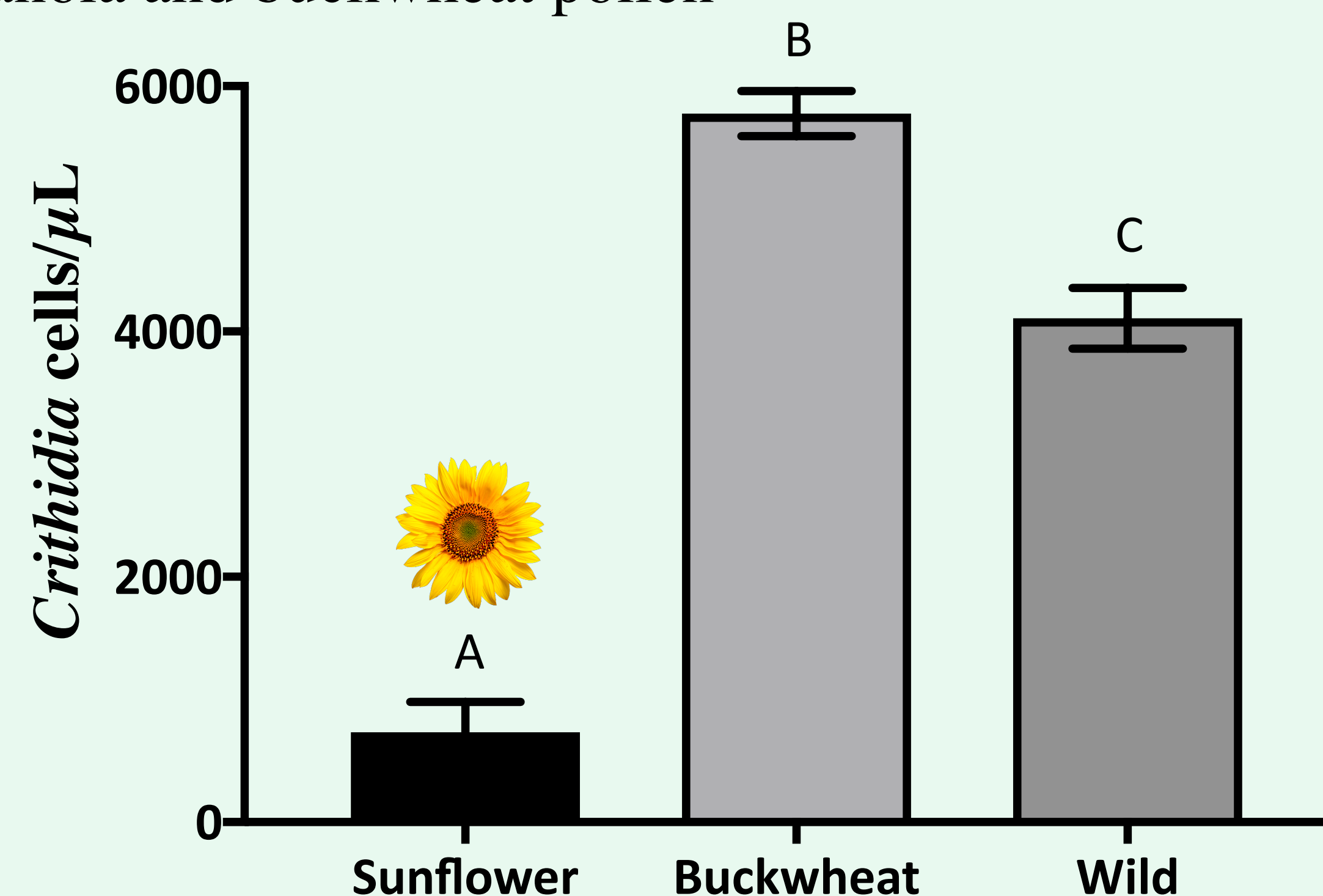


- Bees placed into containers and fed a pollen diet for a period of 1 or 2 weeks, for bumble bees, and 15 days for honey bees.
- Digestive tract dissected out and parasite loads measured using hemacytometer.

Sunflower pollen reduces parasite loads in bumble bees

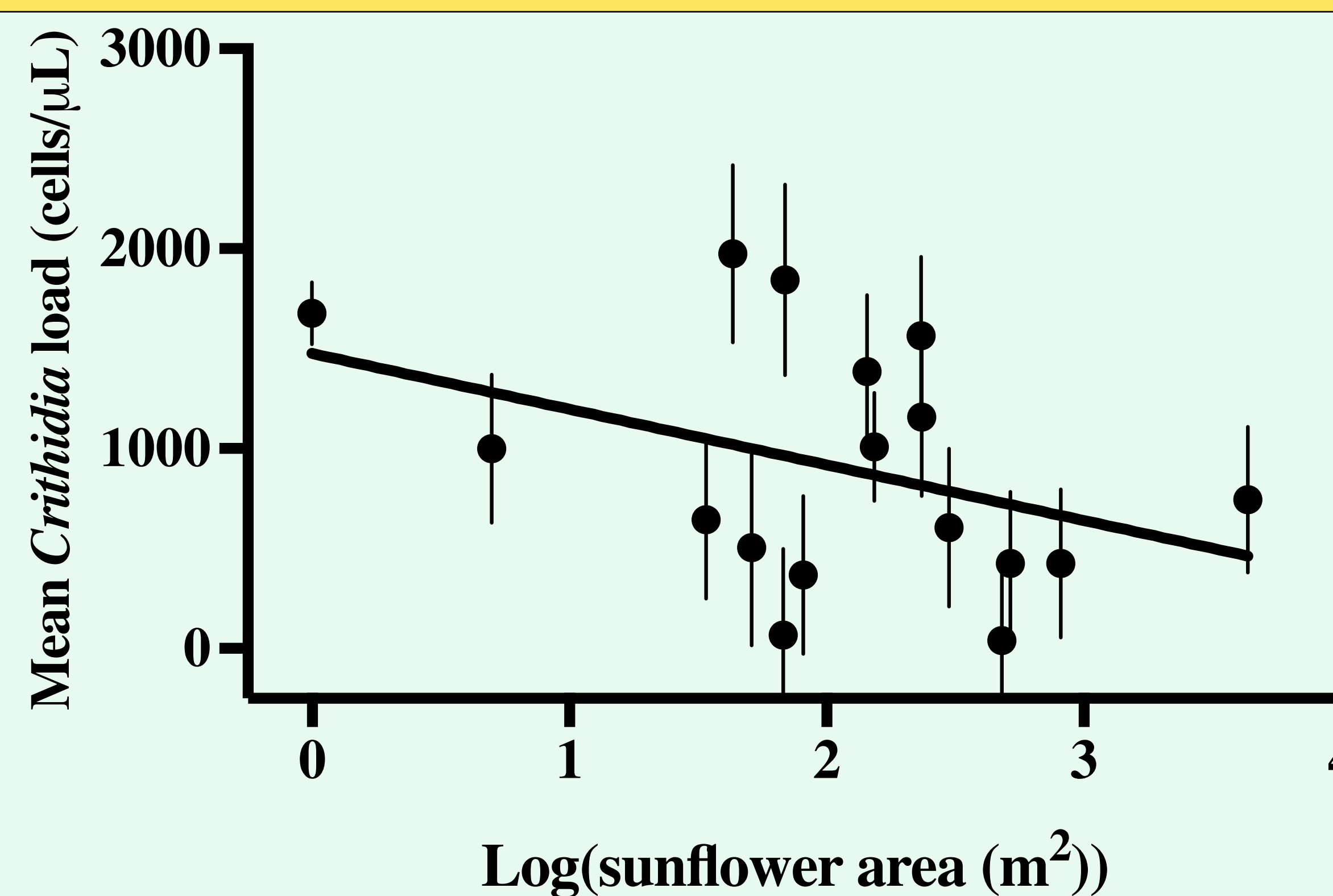


Sunflower pollen had dramatic beneficial effects in reducing parasite loads ($\chi^2_{(3)} = 41.37, P < 0.001$). Infection levels were 20- to 50-fold lower in bees fed sunflower pollen than canola and buckwheat pollen



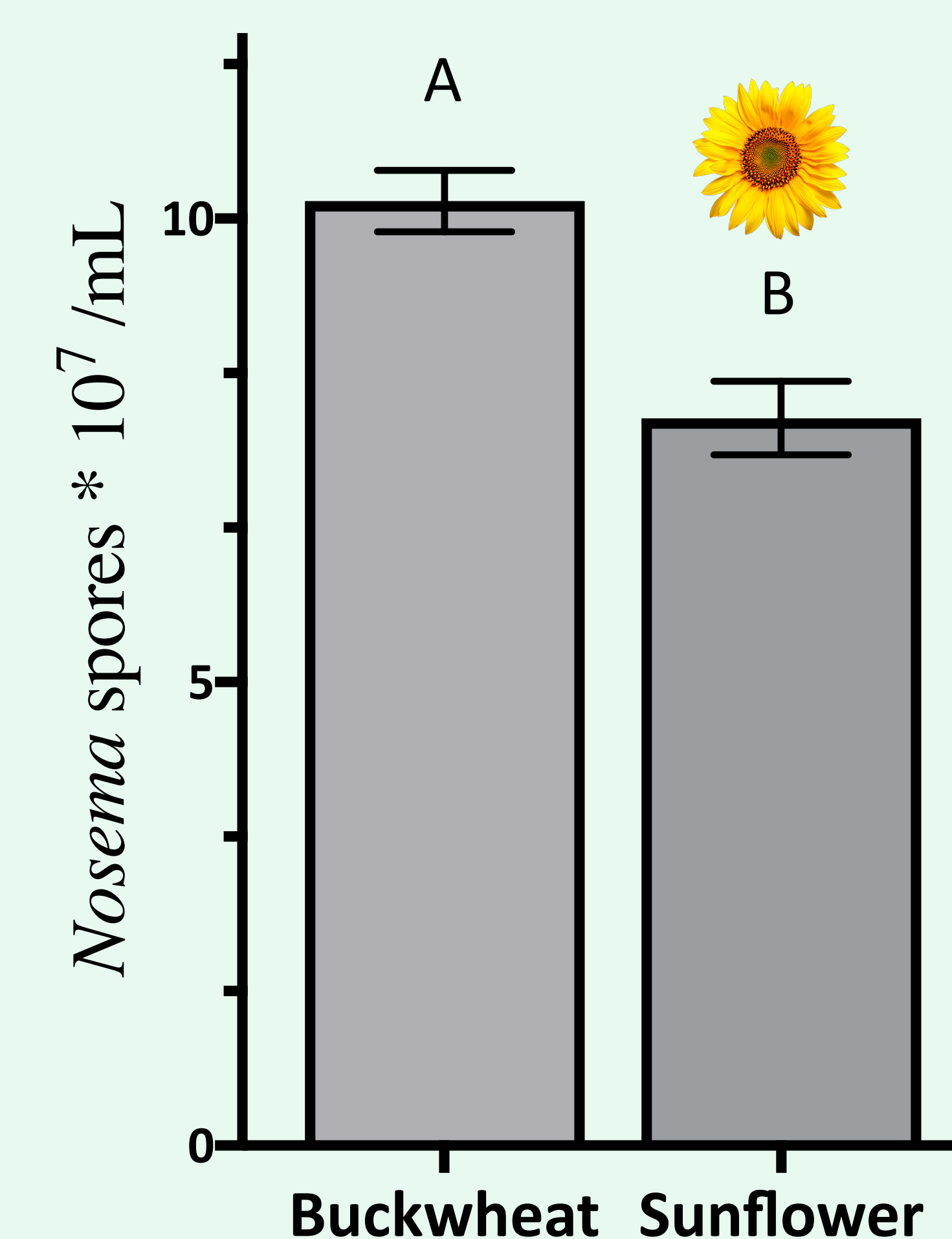
We allowed infection levels to build for one week before providing pollen treatments for a second week. Sunflower pollen drastically reduced infection by 8 and 6-fold, respectively ($\chi^2_{(2)} = 29.86, p < 0.001$)

Sunflower pollen reduces bumble bee parasites at the landscape scale



In summer 2016, we sampled 30 *B. impatiens* workers from each of 22 farms in MA, USA and quantified *Crithidia* infection. Farms varied in the quantity and variety of sunflowers grown. We found a significant, negative relationship between the area of sunflower planted on each farm and disease incidence ($\chi^2_{(1)} = 7.32, p = 0.0068$).

Sunflower pollen reduces parasite loads in honey bees



Sunflower pollen reduced *Nosema* infection in honey bees by 20% relative to buckwheat pollen ($F_{21,1} = 20.3394, p = 0.0002$).

Conclusion

- Sunflower pollen dramatically reduced parasite loads in bumble bees.
- Greater area of sunflower plantings significantly correlates with lower average parasite loads in bumble bees.
- Sunflower pollen significantly reduces major honey bee parasite loads.
- Potential for simple, easily implemented approaches that can reduce disease and increase bee health while relying less on chemicals to treat bee infections.