



Introduction

Many bird species incorporate volatile plant material, such as pine needles, into their nests, which correlate with reduced nest ectoparasite survival.

However, it is unclear whether the material affects parasite survival directly or indirectly through the effects of the plant material on the host's immune system.

We disentangled the direct and indirect effects of α -pinene, the volatile compound in pine needles, on tree swallow (*Tachycineta bicolor*) nestlings and their parasitic nest mites (*Dermanyssus* spp. *Ornithonyssus* spp.).

Hypotheses and Predictions

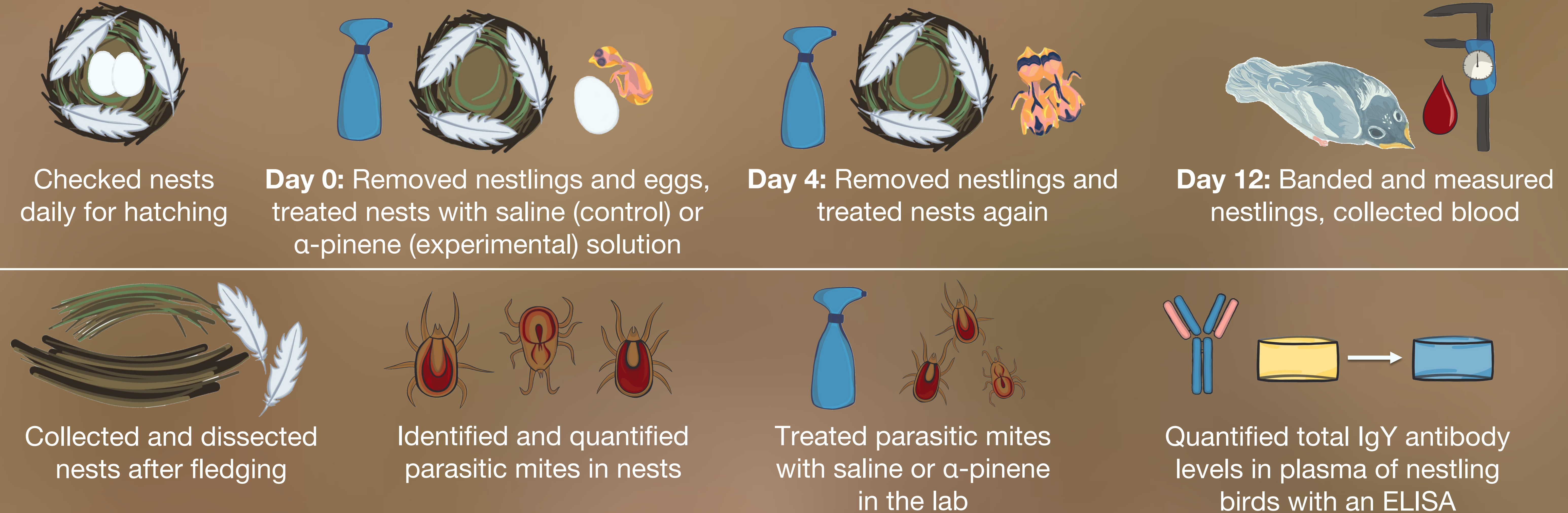
Direct effect of α -pinene \rightarrow treatment will have fewer parasites than the control treatment.

Indirect effect of α -pinene \rightarrow immunoglobulin Y (IgY) levels in experimental nestlings will be lower than in control nestlings.



Photo: Sydney Horan

Methods



Results

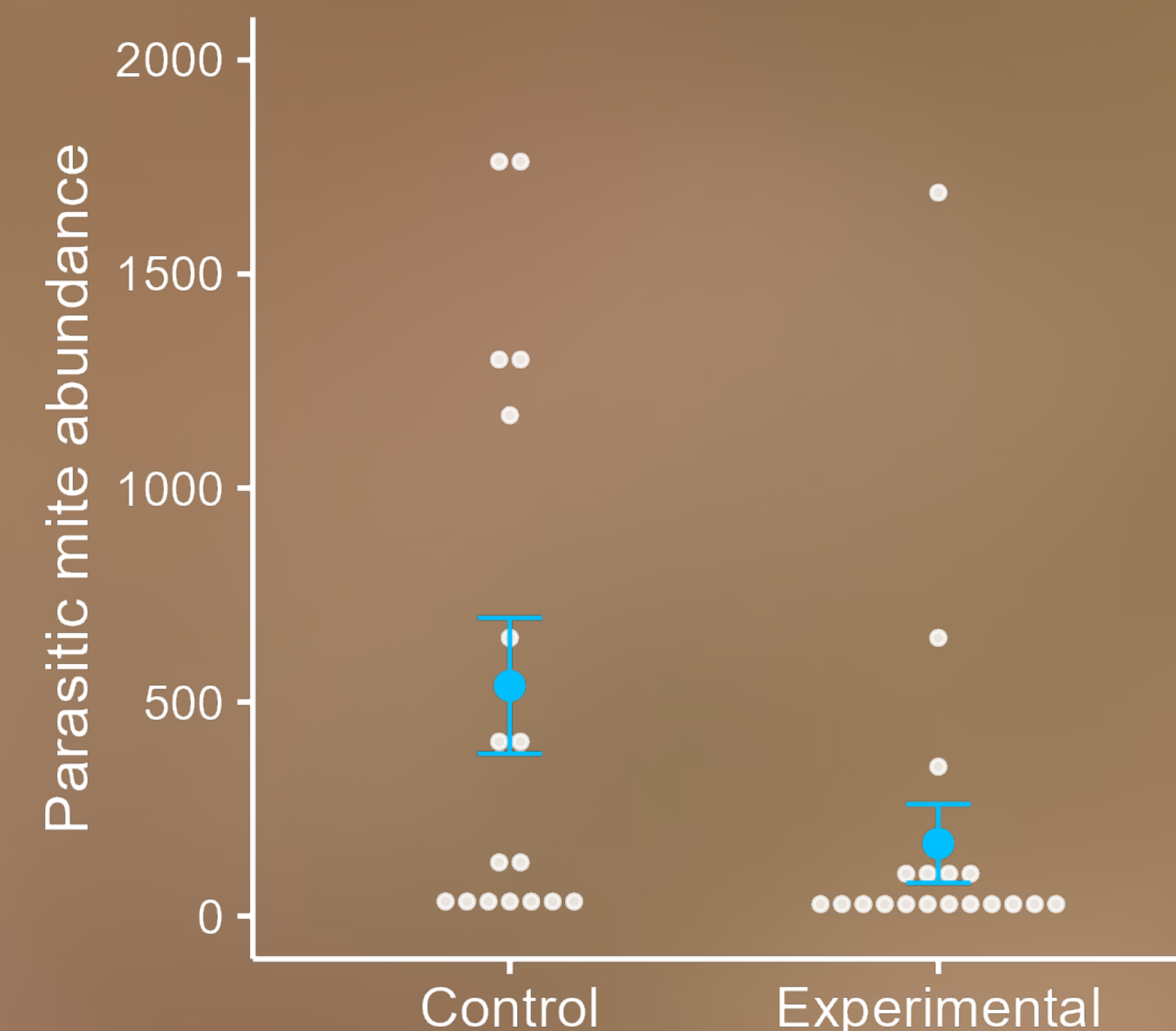


Fig. 1. Nestlings from nests that were treated with α -pinene had fewer parasitic mites than nestlings from control nests (mean \pm SE; GLM: $P = 0.007$). White points represent individual nests (control: $n = 17$ nests; experimental: $n = 19$ nests).

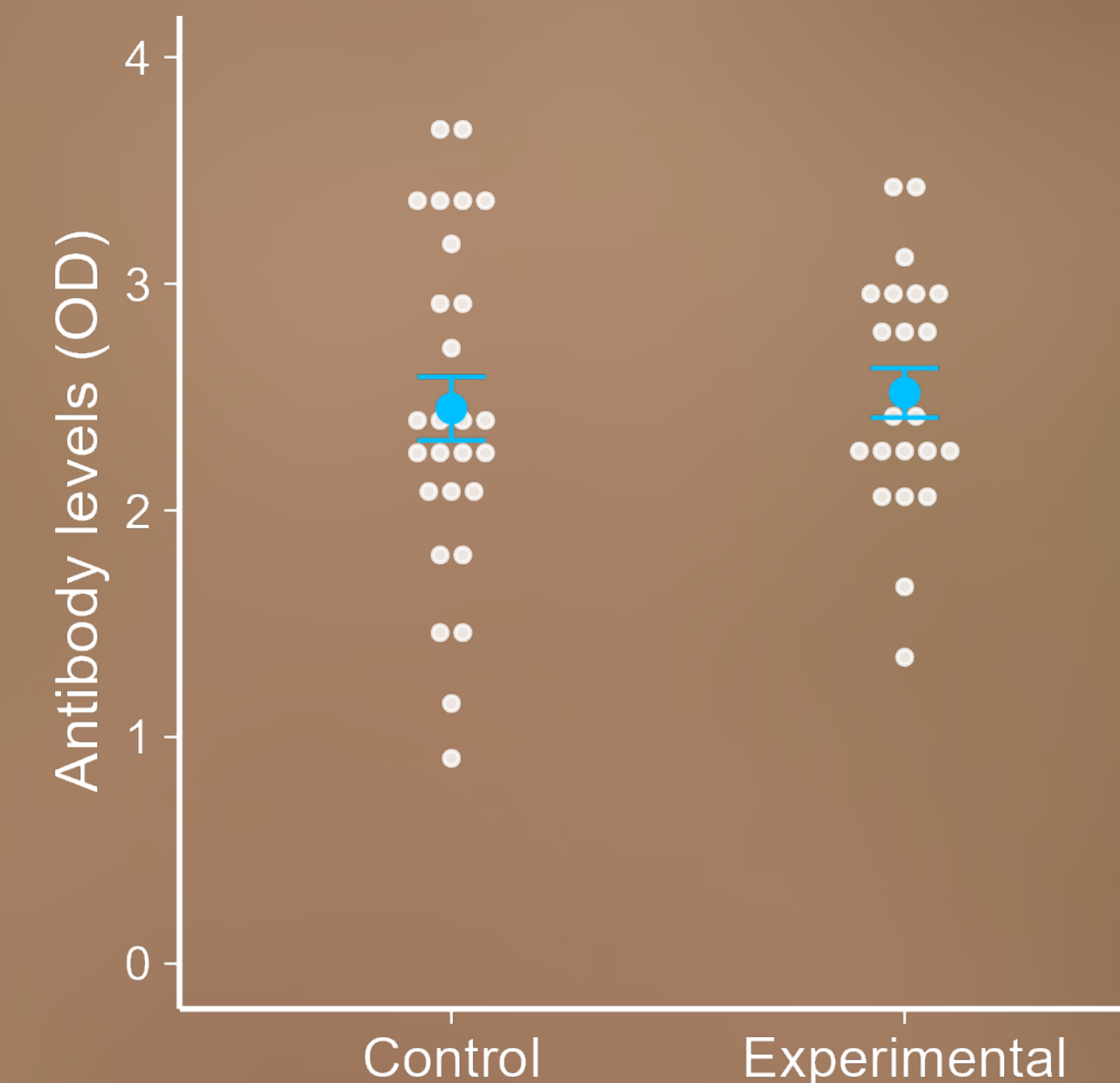


Fig. 2. Total IgY levels in nestlings did not differ significantly between treatments (mean \pm SE; GLMM: $P = 0.28$). Antibody levels were measured as optical densities (OD). White points represent individual nestlings (control: $n = 28$ nestlings; experimental: $n = 23$ nestlings).

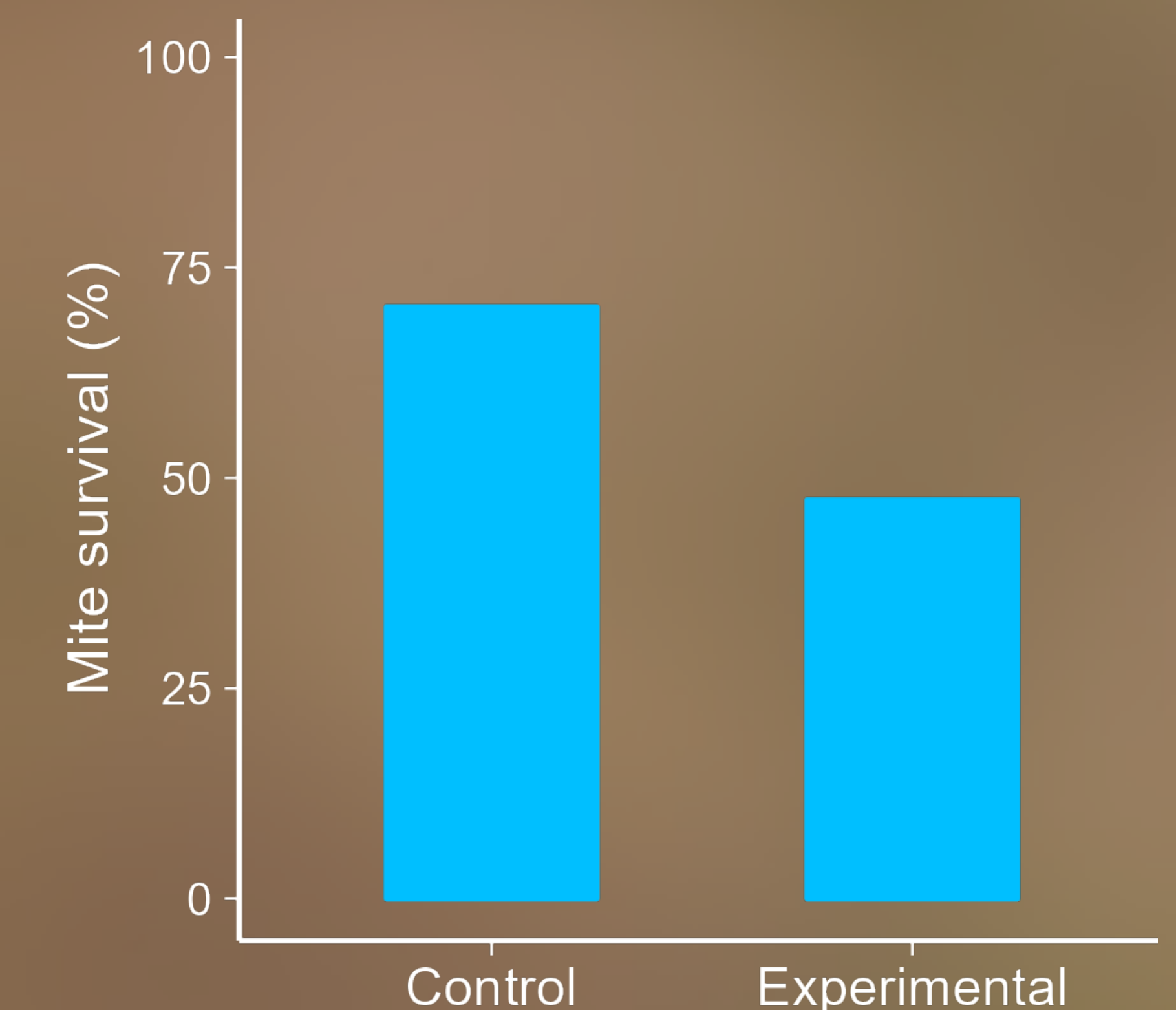


Fig. 3. Preliminary data suggest that parasitic mites that were treated with α -pinene ($n = 2$) had reduced survival compared to controls ($n = 2$) (GLMM: $P = 0.013$).

Discussion

α -pinene reduces nest mite abundance and decreases mite survival, likely by disrupting the nervous system through inhibiting the enzyme acetylcholine esterase.

α -pinene does not affect nestling IgY response, but other immune responses need to be quantified.

Our results suggest that nest pine needles might directly reduce parasite abundances.

Outstanding question: do birds intentionally incorporate pine needles to control for parasites?