**Supporting Information**. Drees, T.H. and K. Shea, 2022. *Climate warming increases insect-driven seed removal of two eliaosome-bearing invasive thistle species*. Pending.

**Appendix S1.** Supporting figures for model results and observed seed removal patterns, as well as photographs of frequently observed insect seed removers.

To qualitatively compare our results derived from GLMs to those from a more typical survival analysis, we fit parametric survival models for each species. Before fitting the survival models, the data were re-structured as single-seed entries with time of removal (if removed) rather than per-depot counts at various time points. Models were then fit using the **survreg** function from the package **survival** version 3.4-0 (Therneau *et al*. 2022), with time to seed removal as a response; elaiosome and warming treatments, as well as their interaction, were encoded as fixed effects. Unfortunately, this package (like many similar survival model packages) does not fully support random effects for the parametric survival models, so we have encoded block as a fixed effect instead. This encoding still lets us account for spatial variation in seed removal rates within the experiment, but does not allow for us to estimate spatial variation outside the context of this experiment. These models were fit testing two parameterisations of the survival and hazard functions: an exponential distribution (constant hazard) and a Weibull distribution (time-varying hazard).

As can be seen in Table S1, the same general trends seen in the GLM results were also seen from the survival models. For both species, significant negative coefficients on warming and elaiosome treatments indicate that increased growing temperatures and presence of the elaiosome each decreased the amount of time it takes for a seed to be removed. Note that while they convey the concept, the treatment coefficients have opposite signs when compared between Table 1 (main text) and Table S1 since the model for the former examines proportion of seeds *removed* as the response, while the model for the latter examines how long seeds *remain* before being removed.

Comparing the Weibull and exponential distributions, the Weibull had a lower AIC in both *C. nutans* (6911 versus 6947) and *C. acanthoides* (7019 versus 7271), and thus seemed to be a better candidate for the underlying survival and hazard functions, suggesting that the hazard varied through time. In both species, the Weibull fit had a scale parameter less than 1: 0.84 in *C. nutans* (*n* = 1000, *z* = -6.42, *p* < 0.001) and 0.62 in *C. acanthoides* (*n* = 975, *z* = -17.53, *p* < 0.001). This indicates that the risk of removal decreases over time.

**Table S1.** Estimates (1 standard error), -scores, and -values for the coefficients of the parametric survival models. The intercept (baseline) represents seeds from unwarmed maternal plants and without elaiosomes in the first experimental block. Estimates must be exponentiated to yield the mean time to removal for seeds that were removed.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***C. nutans* (*n* = 1000)** | | |  | ***C. acanthoides* (*n* = 975)** | | |
|  |  |  |  |  |  |  |  |
| **6 Hours** | **Estimate** | ***z*** | ***p*** |  | **Estimate** | ***z*** | ***p*** |
| Intercept | -3.394 0.515 | -6.596 | <0.001 |  | -3.827 0.451 | -7.281 | <0.001 |
| Warming | 2.273 0.321 | 7.085 | <0.001 |  | 1.965 0.334 | 5.887 | <0.001 |
| Elaiosome | 2.374 0.321 | 7.398 | <0.001 |  | 1.775 0.336 | 5.290 | <0.001 |
| Warming:Elaiosome | -0.924 0.385 | -2.399 | 0.016 |  | -2.397 0.418 | -5.733 | <0.001 |
| Block |  |  |  |  |  |  |  |
| 2 |  |  | <0.001 |  |  |  | <0.001 |
| 3 |  |  | <0.001 |  |  |  | <0.001 |
| 4 |  |  | <0.001 |  |  |  | <0.001 |
| 5 |  |  | <0.001 |  |  |  | <0.001 |
| 6 |  |  | <0.001 |  |  |  | <0.001 |
| 7 |  |  | <0.001 |  |  |  | <0.001 |
| 8 |  |  | <0.001 |  |  |  | <0.001 |
| 9 |  |  | <0.001 |  |  |  | <0.001 |
| 10 |  |  | <0.001 |  |  |  | <0.001 |
|  |  |  |  |  |  |  |  |
| **12 Hours** |  |  |  |  |  |  |  |
| Intercept | -1.662 0.426 | -3.904 | <0.001 |  | -3.295 0.552 | -5.974 | <0.001 |
| Warming | -0.158 0.275 | -0.574 | 0.566 |  | 3.263 0.403 | 8.090 | <0.001 |
| Elaiosome | 1.670 0.263 | 6.338 | <0.001 |  | 2.980 0.385 | 7.748 | <0.001 |
| Warming:Elaiosome | 0.584 0.401 | 1.455 | 0.146 |  | -3.374 0.456 | -7.402 | <0.001 |
| Block |  |  |  |  |  |  |  |
| 2 |  |  | <0.001 |  |  |  | <0.001 |
| 3 |  |  | <0.001 |  |  |  | <0.001 |
| 4 |  |  | <0.001 |  |  |  | <0.001 |
| 5 |  |  | <0.001 |  |  |  | <0.001 |
| 6 |  |  | <0.001 |  |  |  | <0.001 |
| 7 |  |  | <0.001 |  |  |  | <0.001 |
| 8 |  |  | <0.001 |  |  |  | <0.001 |
| 9 |  |  | <0.001 |  |  |  | <0.001 |
| 10 |  |  | <0.001 |  |  |  | <0.001 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

Therneau, T.M. (2022). A package for Survival Analysis in R. CRAN. R Foundation for Statistical Computing, Vienna, Austria.