**Supplementary material Section S1:**

**Mathematical description of the models used**

We assumed that the mean of the normal distribution (for length of overwinter period) or WN distribution (for start of season and end of season) had a linear relationship with environmental drivers. When performing analyses for the *Avaritia* females this relationship was assumed to be of the form



where is the expected value of the response variable for site *i* in year *j* and are the values of the *k*-th environmental variable at site *i* in year *j*. Parameters  and are random effects that are each assumed to be normally distributed with zero mean and unknown variance

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these random effects reflect, respectively, unstructured temporal heterogeneity (variation between years) and unstructured spatial heterogeneity (variation between sites). The intercept *a*, regression coefficients *bk*, random effect variances σγ2  and σφ2  and residual variance σε2 are all unknown parameters.

For the analysis of the *Avaritia* males the relationship is assumed to be of the form



where is the expected value of the response variable for species *k* at site *i* in year *j*, summed across *l* environmental variables (*x*), and



is a random effect reflecting the combined effects of spatial and temporal variation. The additional parameters *αi* and *βik* represent species-specific intercepts and species-environment interactions respectively.