Habitat association of butterflies and their foodplants within nature reserves in Bedfordshire, UK

Supplementary Materials

Table S1: Ecological traits of the 11 species of day-flying Lepidoptera used in this study (from Asher et al. 2001).

<table>
<thead>
<tr>
<th>Species</th>
<th>Family</th>
<th>Habitat specialism</th>
<th>Overwintering life stage</th>
<th>Voltinism</th>
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<tbody>
<tr>
<td><em>Erynnis tages</em></td>
<td>Hesperiidae</td>
<td>Specialist</td>
<td>Larva</td>
<td>Multivoltine</td>
</tr>
<tr>
<td><em>Cupido minimus</em></td>
<td>Lycaenidae</td>
<td>Specialist</td>
<td>Larva</td>
<td>Multivoltine</td>
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<tr>
<td><em>Polyommatus coridon</em></td>
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<td>Specialist</td>
<td>Egg</td>
<td>Univoltine</td>
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<tr>
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<td>Nymphalidae</td>
<td>Generalist</td>
<td>Adult</td>
<td>Univoltine</td>
</tr>
<tr>
<td><em>Aglais urticae</em></td>
<td>Nymphalidae</td>
<td>Generalist</td>
<td>Adult</td>
<td>Multivoltine</td>
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<td>Larva</td>
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<tr>
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<td><em>Anthocharis cardamines</em></td>
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<td>Generalist</td>
<td>Pupa</td>
<td>Univoltine</td>
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<tr>
<td><em>Gonepteryx rhamni</em></td>
<td>Pieridae</td>
<td>Generalist</td>
<td>Adult</td>
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<td>Generalist</td>
<td>Pupa</td>
<td>Multivoltine</td>
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<td><em>Zygaena filipendulae</em></td>
<td>Zygaenidae</td>
<td>Generalist</td>
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Table S2: Explanatory variables (plant height, vegetation height, and plant density) tested for multicollinearity before fitting conditional logistic models. All tests were conducted within species (ordered alphabetically by family and species). As a result of high correlations between plant height and vegetation height (p-values < 0.05 and correlation coefficients >0.7 (Dormann et al. 2013), in bold), vegetation height was excluded from subsequent analyses.

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<tr>
<th>Terms</th>
<th>Correlation coefficient</th>
<th>P-value</th>
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<td>Significance</td>
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Table S3: The results of Chi Square tests and associated Cramer’s V between Lepidoptera and their habitat associations with reserve-scale environmental characteristics: aspect (North, East, South, West, or Flat if the slope is <10°), and vegetation type (short grass (<10 cm), long grass (>10 cm), or encroaching scrub (25-75% of the surrounding 5 m² contains scrub). Three tests were run per species*; the Foodplant (observed distribution of the foodplant with the proportional habitat availability across the sites surveyed used to calculate expected frequencies), the Larva (observed distribution of the larva with the proportional habitat availability across the sites surveyed used to calculate expected frequencies), and the Larva*Foodplant (observed distribution of the larva with the proportional foodplant distribution per habitat type used to calculate the expected frequency). Where counts were too low for analysis, NAs are given. Significant associations are in **bold**.

* Maniola jurtina had only one test run (Larva distributions), as they feed on grass and the distribution of their foodplants could not be mapped.

<table>
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<tr>
<th>Aspect</th>
<th>Chi sq</th>
<th>P-value</th>
<th>Cramer's V</th>
<th>Vegetation type</th>
<th>Chi sq</th>
<th>P-value</th>
<th>Cramer's V</th>
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<td>Foodplant</td>
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<td>Pieris napi</td>
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</table>
Table S4: The results of conditional logistic regressions between larval presence and foodplant characteristics (foodplant height (cm) and foodplant density (either as a count of individual foodplants or, in cases where foodplants were non-distinct and overlapping, as percentage cover within 30 cm of the foodplant). Tests were run individually by species (ordered alphabetically by family and species). Species sampled by suction sampler (*Maniola jurtina, Zygaena filipendulae*) were excluded from this analysis, as it was not possible to determine which specific foodplant they occupied before capture.

<table>
<thead>
<tr>
<th>Term</th>
<th>Coefficient</th>
<th>Exponentiated coefficient</th>
<th>Standard error</th>
<th>Lower 95% C.I.</th>
<th>Upper 95% C.I.</th>
<th>P-value</th>
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<tr>
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<td>0.038</td>
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<td>0.996</td>
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<tr>
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<td>1.008</td>
<td>0.01</td>
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<td>0.011</td>
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<td>0.022</td>
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<td>0.036</td>
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<td>1.032</td>
<td>0.008</td>
<td>1.016</td>
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<td>0.072</td>
<td>0.836</td>
<td>1.109</td>
<td>0.601</td>
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### Pieris napi

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<td>Foodplant density</td>
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<td>1.093</td>
<td>0.134</td>
<td>0.841</td>
<td>1.42</td>
<td>0.507</td>
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Figure S1: The strength of association (Cramer’s V) of foodplants (Foodplant) and larvae (Larva) against the total available habitat area, and of larvae against the foodplant distribution (Larva * foodplant), for habitat generalists and specialists for cardinal aspect (A, B), and vegetation type (C, D).
(C, D). Horizontal dashed lines indicate weak, moderate, and strong associations to aid interpretation, calculated from the degrees of freedom. All data points are shown; significant values are denoted with triangles, non-significant values are denoted with circles. Lines connect datapoints within foodplant-Lepidoptera species pairs.
Figure S2: The strength of association (exponentiated coefficients from conditional logistic regressions) of larval presence against foodplant characteristics, foodplant height (cm), and foodplant density (either as individual counts or percentage cover within 30 cm). All data points are shown; significant values are denoted with triangles, non-significant values are denoted with circles. Lines connect datapoints of the same species.
References