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Hamearis lucina prefers west-facing slopes for oviposition in calcareous grasslands in Germany

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Within-patch habitat quality accompanies patch size and isolation as a third major factor that determines the persistence of butterflies in cultivated landscapes. Selected egg laying sites can serve as a good proxy for a definition of optimal habitat quality (see review in Garcia-Barros & Fartmann submitted). The knowledge of *Hamearis lucina* oviposition sites in Central Europe is still poor.

The study area (hereafter called Diemel Valley) is located in Central Germany along the border between the federal states of North Rhine-Westphalia and Hesse (51°22'N/8°38'E and 51°38'N/9°25'E) at an elevation of 100 to 610 m a.s.l. The climate is suboceanic and varies greatly according to altitude. Calcareous grasslands – the only breeding sites of *H. lucina* in the Diemel Valley – cover about 750 ha (2% of the total area) (Fartmann 2004).

On occupied sites, systematic samples of *Primula veris* on a 5 × 5 or 10 × 10 m grid were searched for eggs. Microhabitat structure was analysed in a radius of 50 cm around each used plant following Anthes et al. (2003) and Fartmann (2004). For comparing occupied and available host plants, 49 vegetation relevés of 16 m² with presence of *Primula veris* according to the Braun-Blanquet methodology were used. They represented all potential *H. lucina* habitat types corresponding to their area proportion in the Diemel Valley (Fartmann 2004, submitted; Anthes et al. submitted).

Oviposition sites (n = 416 eggs) were characterised by high total vegetation coverage (median: 100%). More than three quarters of all eggs were found on places with more than 60% herb layer coverage (median: 100%). On relatively cool northwest-facing slopes or where tree or shrub coverage was high, sites with open turf were used as well. Usually, the coverage of mosses and lichens was low (median: 20%). However, where abundance of higher plants was low, up to 90% coverage was possible. There was always a certain amount of litter; mostly between 10 and 25% (median: 15%). Gravel, stones, rocks; bare ground and trees were of little significance in the egg-laying sites of *H. lucina*. A shrub layer often existed, but at low coverage (median: 10%). The oviposition sites of *H. lucina* were characterised by a cover of mosses and lichens, bare ground and gravel, stones and rocks significantly lower than at randomly selected available *Primula veris* plants (Figure 1). Higher coverage by shrubs and litter was significantly preferred.

Sward height at oviposition sites (median turf height: 20 cm, n_{used} = 416) was significantly higher than that at randomly chosen available plants (median turf height: 15 cm, $n_{avail.}$ = 49, Mann-Whitney U Test, U = 6642.5, P <0.005). The analysis of horizontal vegetation coverage at different heights above ground further showed that vegetation cover was very dense near the ground (median in 5 cm height: 80%, 1. to 3. quartile: 50–100%), but already drastically decreased at 10 cm above ground (median: 30%) and was negligible further up.

When compared to available *Primula veris* sites oviposition sites were predominantly situated on westerly to southerly exposed slopes (χ^2 = 215.1, df = 4, P <0.001). Aspect and inclination are linked with maximal potential sunshine at the egg-laying sites. Most eggs were found on sites with 4–8 hours of sunshine in May (median: 6 h). However, insolation at egg-laying sites further varied according to their aspect: While south- and southwest-facing larval habitats only receive about 4.5 and 5 h direct insolation in May, it was 7 and 9 h on west- and north-facing slopes, respectively.

The results indicate that *H. lucina* requires shrubby semi-dry calcareous grasslands with high total vegetation coverage on west-facing slopes at its northern distribution margin in Central Europe. But why does *H. lucina* prefer west-facing slopes? It appears very likely that southern aspects are usually too hot and dry in May and June, so that host plants are prone to desiccation. Furthermore, a high humidity seems to be necessary for the development of the eggs. Egg-laying on the undersides of leaves, as opposed to the top, and the dense layers of herbs, mosses and litter that are able to store humidity are in line with this hypothesis. Eastern aspects, in contrast, are rarely used, presumably because they do not warm up sufficiently to enable egg development.

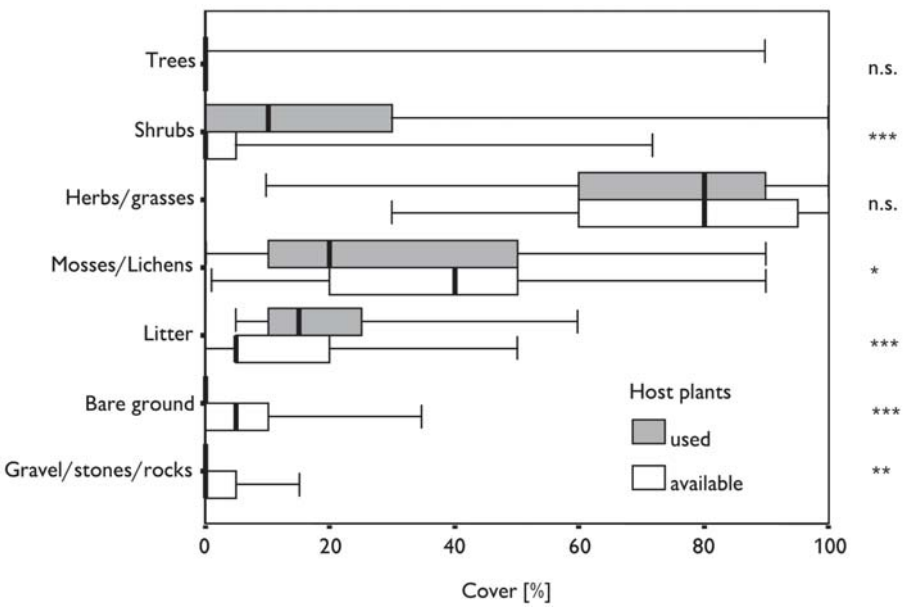

Fig. 1. Coverage of different vegetation layers at available and occupied host plants of *Hamearis lucina* in the Diemel Valley. Box-plots show maximum, minimum, interquartile range, and median coverage (%). * P <0.05, ** P <0.005, *** P <0.001, n.s.: not significant, Mann-Whitney U Test. $n_{avail.}$ = 49, n_{used} = 416.

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