Supplementary material S1 for: Niermann J.& Brehm G. 2022: The number of moths caught by light traps is affected more by microhabitat than the type of UV lamp used in a grassland habitat. — *Eur. J. Entomol.* 119: 36–42.

The number of moths caught by light traps is more affected by microhabitat than the type of UV used in a grassland habitat

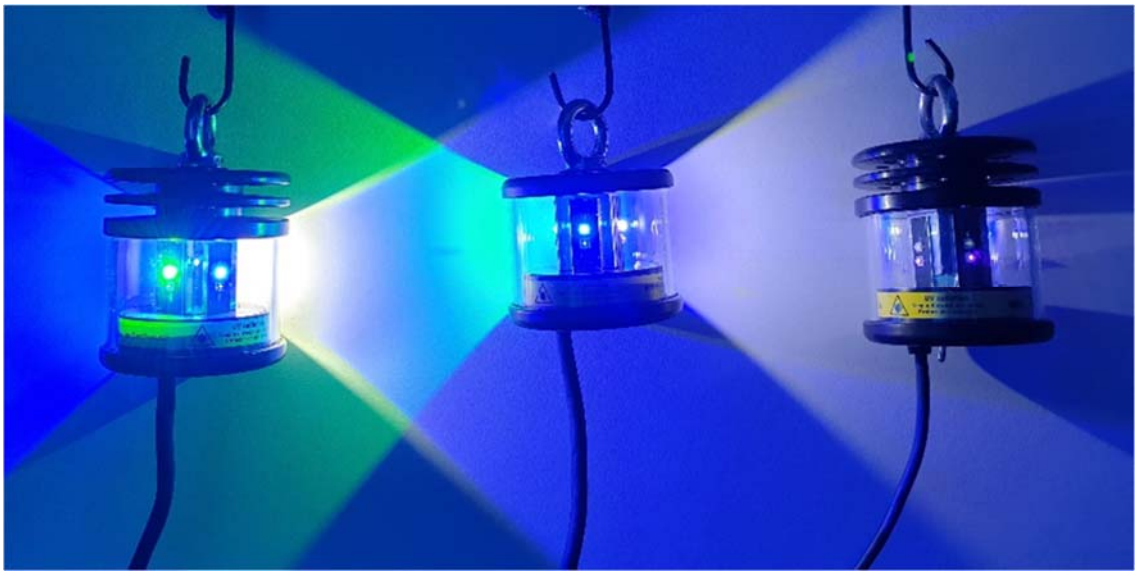

Figure S1. LepiLED models *maxi* (radiant flux 1.34 W, power consumption 13 W), *mini* (0.55 W, power consumption 4 W) and *maxi switch UV mode* (0.59 W, power consumption 6.5 W).

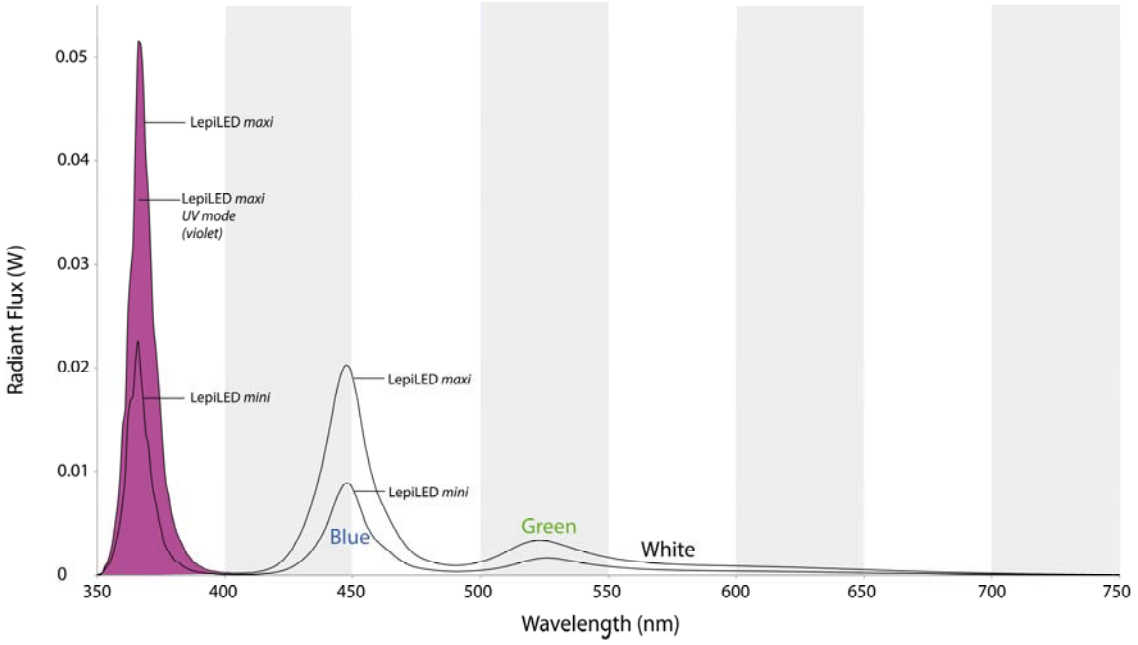

Figure S2. Radiant flux graph of a LepiLED *maxi* (multiple peaks), a *mini* (multiple peaks), and a *UV* lamp (= *maxi UV mode*; violet; single peak) used in the experiment.

Figure S3. The lamps with funnel traps and nets as used in this study (habitat 1: orchard meadow, with exposed site 1 in the foreground), site 3 in the centre (moderately sheltered) and site 2 on the right (sheltered).

Figure S4a. Habitat 1 (orchard meadow). A semi-dry lawn with partially dead orchard trees on the lower part of the southern slope at an elevation of 245 m to 261 m. The lamps were positioned in a triangular arrangement along the elevational gradient at distances of 39.2 m (location 1 and 2) and 33.2 m. Site 1 is significantly more exposed and is located at the lower end of the meadow (see large lamp in Appendix figure 3) far away from the surrounding vegetation. Site 2 is in the centre of the orchard meadow, very close to bushes. Site 3 is in the upper area, where there are stands of low trees, some rubble and open ground areas. In addition to grasses, these plant communities include *Anthericum ramosum*, *Euphorbia cyparissias*, *Geranium sanguineum*, *Cirsium vulgare*, *Lathyrus hirsutus*, *Bupleurum falcatum*, *Agrimonia eupatoria*, *Origanum vulgare*, *Centaurea scabiosa*, *Echium vulgar*e, *Galium mollugo*, *Ononis repens*, *Knautia arvensis* and *Gymnadenia conopsea*. Immediately adjacent are predominantly young hardwood populations, which are primarily composed of *Fraxinus excelsior*, invasive *Robinia pseudoacacia*, *Betula pendula*, *Carpinus betulus*, some *Quercus spp*., *Acer campestre*, *Prunus spinosa*, *Crataegus sp*. and *Viburnum lantana*. In the upper area there is semi-arid grassland. See also Figure 5 with a map.

Figure S4b. Habitat 2 (dry grassland). Located in the upper section of the Jenzig area, with the individual lamps at approximately the same elevation. It is on a steep slope with a high proportion of gravel and rubble along the lower border of a black pine (introduced *Pinus nigra*) stand. Due to the significantly higher location, the temperature inversion, which starts at about 250 m at Jenzig, has a stronger influence here and the maximum temperatures are higher (Heinker et al. 2017). On one of the isolated black pines, the exposed location 4 was established at an elevation of 373 m, where it is above a sparsely vegetated area with rubble. Site 5 is located at a distance of 32 m on the edge of the black pine stand, the area below which is overgrown with predominantly herbaceous plants, but clear areas. Site 6 is another 26.4 m away. The slope here is significantly more covered with dense vegetation with partially lignified bushes. The undergrowth in habitat 2 is primarily composed of species of the xerothermic bush communities typical of the area: *Ligustrum vulgare, Viburnum lantana, Rosa canina, Cornus sanguinea, Prunus spinosa*. Occasionally there are young deciduous trees of *Fraxinus excelsior* and *Tilia platyphyllos*. Here, too, there are bushes, mostly in the lower area. The open ground is partially covered with various herbaceous plants, mostly *Anthericum ramosum, Thymus praecox, Lavandula angustifolia, Odontites vernus, Silene vulgaris, Meliolotus albus, Salvia pratensis* and various grasses. See also Figure 5 with a map.

Figure S5. Map of Germany with Jena marked in orange and aerial photographs of the two habitats with the six sites sampled marked with yellow circles: 1–3 in an orchard meadow and 4–6 in dry grassland on a steep slope. e = exposed, ms = medium sheltered, s = sheltered. Original image data © **GDI-Th** dl-de/by-2-0 https://www.geoportal-th.de/de-de/Downloadbereiche/Download-Offene-Geodaten-Th%C3%BCringen/Download-Luftbilder-und-Orthophotos (accessed 27. June 2021).

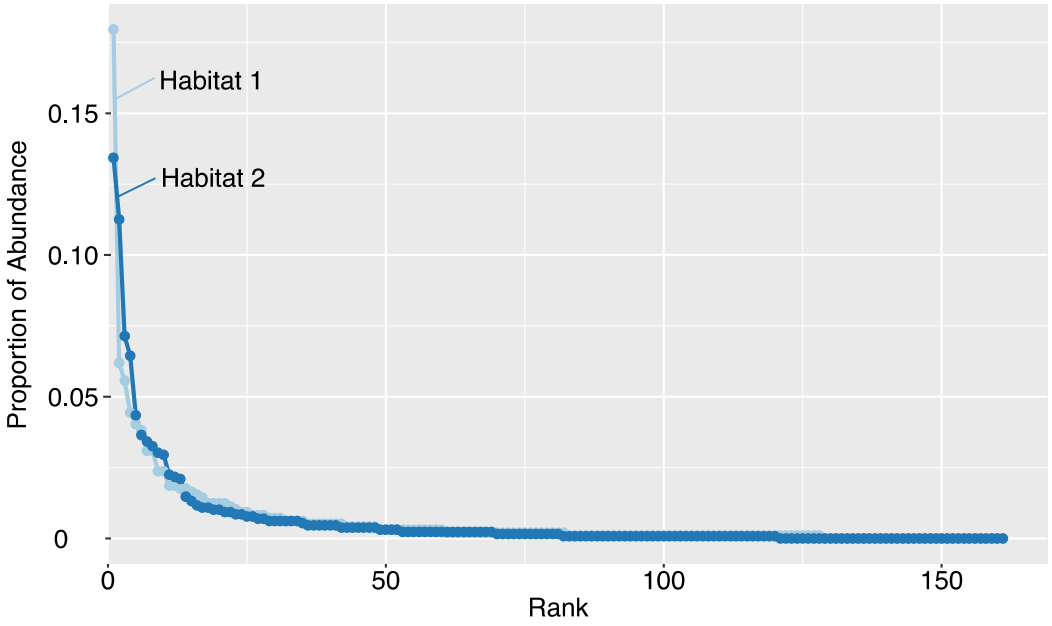

Figure S6. Species abundance curves (Whittaker plots) for the two habitats, showing similar abundance relationships

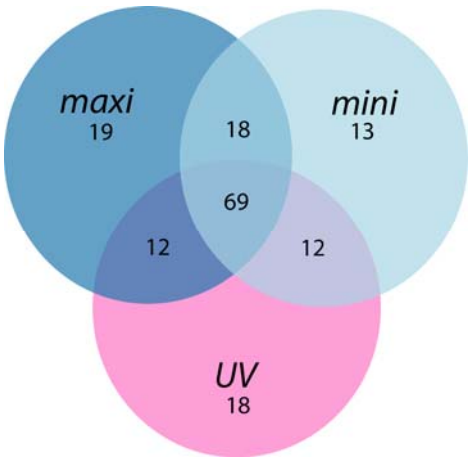

Figure S7. Venn diagram of species overlap (total 161 species) of the catches of three lamps.

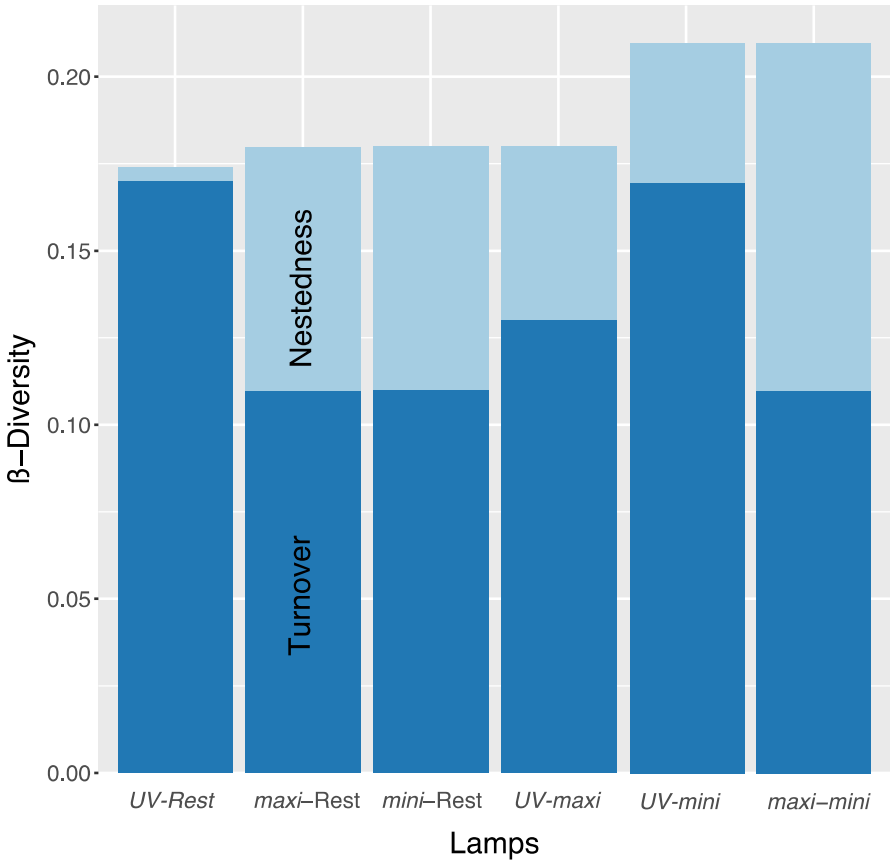

Figure S8. Beta diversities of the catches of the three lamps partitioned between turnover and nestedness.

Table S1. List of the six sites sampled.

	Latitude / longitude		**Elevation**	**Exposure**
Habitat 1, site 1	50°56’12”N	11°37’37”E	245 m	exposed
Habitat 1, site 2	50°56’13”N	11°37’38”E	255 m	sheltered
Habitat 1, site 3	50°56’14”N	11°37’37”E	261 m	moderately sheltered
Habitat 2, site 4	50°56’12”N	11°38’02”E	373 m	exposed
Habitat 2, site 5	50°56’19”N	11°38’06”E	380 m	moderately sheltered
Habitat 2, site 6	50°56’19”N	11°38’07”E	382 m	sheltered

Table S2. Minimum adequate generalized linear mixed models of negative binomial distribution (maximum likelihood method), which illustrates the relationship between the type of lamp used and the log-transformed number of individuals and species caught per night and lamp (n=36), according to Dunnet (individuals: AIC 315.0, BIC 329.2, deviance 297.0, residual df 27; species: AIC 234.9, BIC 247.5, deviance 218.9, residual df 28).

	exp (Estimate)	exp (SE)	Z-Value	Pr(>|z|)[c]	95% CI-Interval[b]	
Individuals						
Fixed Effects						
(Intercept)[a]	6.18	0.23	26.63	<0.001***	5.72	6.63
Lamp - *mini*	-0.34	0.09	-3.75	<0.001***	-0.52	-0.16
Lamp - *UV*	-0.22	0.09	-2.45	0.01*	-0.40	-0.04
Humidity	-0.03	0.00	-8.59	<0.001***	-0.03	-0.02
Wind	-0.19	0.06	-3.30	<0.001***	-0.31	-0.08
Random Effects	exp (Variance)	exp (SD)				
Site:Habitat	0.07	0.27				
Round	0.01	0.01				
Species						
Fixed Effects						
(Intercept)[a]	3.75	0.22	17.12	<0.001***	3.32	4.18
Lamp - *mini*	-0.20	0.08	-2.49	0.01*	-0.36	-0.04
Lamp - *UV*	-0.18	0.08	-2.25	0.02*	-0.34	-0.02
Humidity	-0.01	0.00	-2.23	0.03*	-0.01	0.00
Random Effects	exp (Variance)	exp (SD)				
Site:Habitat	0.01	0.14				
Habitat	0.01	0.01				
Round	0.01	0.09				

(a) Baselines *maxi*, humidity 0 %, wind 1

(b) 95 % CI-Interval according to Wald-method

(c) Level of significance *** p<0.001 ** p<0.01 * p<0.05

Table S3. Minimum adequate generalised linear mixed models of negative binomial distribution (maximum likelihood method). There is no significant correlation between habitat and log-transformed number of individuals and species caught per night and lamp (n = 36), pair comparisons according to Dunnett (individuals: AIC 336.0, BIC 348.7, deviance 320.0, residual df 28; species: AIC 239.9, BIC 252.6, deviance 223.9, residual df 28).

	exp (Estimate)	exp (SE)	Z-Value	Pr(>|z|)[c]	95% CI-Interval[b]	
Individuals						
Fixed Effects						
(Intercept)[a]	4.50	0.34	13.30	<0.001***	3.83	5.16
Habitat 2	0.13	0.22	0.60	0.55	-0.30	0.56
Wind	-0.25	0.08	-3.06	<0.001**	-0.41	-0.09
Cloud cover	0.01	0.00	-2.21	0.03*	-0.01	0.01
Random Effects	exp (Variance)	exp (SD)				
Site:Habitat	0.05	0.23				
Lamp	0.02	0.14				
Round	0.10	0.32				
Species						
(Intercept)[a]	3.24	0.18	17.58	<0.001***	2.88	3.61***
Habitat 2	0.07	0.14	0.51	0.61	-0.20	0.34
Wind	-0.08	0.06	-1.51	0.13	-0.19	0.02
Cloud cover	0.00	0.00	-0.09	0.93	0.00	0.00
Random Effects	exp (Variance)	exp (SD)				
Site:Habitat	0.02	0.15				
Lamp	0.01	0.09				
Round	0.02	0.16				

(a) Baselines habitat 1, humidity 0 %, wind 0

(b) 95 % CI-Interval according to Wald-method

(c) Level of significance *** p<0.001 ** p<0.01 * p<0.05

Table S4. Minimum adequate generalized linear mixed models of negative binomial distribution (maximum likelihood method), which illustrates the relationship between site and the log-transformed number of individuals and species caught per night and lamp (n = 36). Contrast method according to Dunnett (individuals: AIC 327.4, BIC 341.7, deviance 309.4, residual df 27; species: AIC 228.6, BIC 241.2, deviance 212.6, residual df 28). The sites include: exposed sites (# 1 and 4), moderately sheltered sites (# 3 and 5), as well as sheltered sites (# 2 and 6). Each consists of one site in habitat 1 and one in habitat 2.

	exp (Estimate)	exp (SE)	Z-Value	Pr(>|z|)	95 % CI-Interval[b]	
Individuals						
(Intercept)[a]	0.36	0.27	15.95	<0.001***	3.82	4.90
sheltered	0.34	0.12	2.91	0.004**	0.11	0.57
moderately sheltered	0.56	0.12	4.83	<0.001***	0.33	0.79
Wind	-0.30	0.07	-4.43	<0.001***	-0.43	-0.17
Cloud cover	0.00	0.00	-2.84	0.005**	-0.01	0.00
Random Effects	exp (Variance)	exp (SD)				
Lamp	0.02	0.15				
Habitat	0.00	0.00				
Round	0.09	0.30				
Species						
(Intercept)[a]	3.09	0.15	20.99	<0.001***	2.30	3.37
sheltered	0.26	0.09	2.97	0.003**	0.09	0.42
moderately sheltered	0.39	0.08	4.59	<0.001***	0.22	0.55
Wind	-0.10	0.05	-2.08	0.038*	-0.20	-0.01
Random Effects	exp (Variance)	exp (SD)				
Lamp	<0.01	<0.01				
Habitat	<0.01	<0.01				
Round	<0.01	<0.01				

(a) Baselines category exposed (sites 1+4), humidity 0 %, cloud cover 0

(b) 95 % CI-Interval according to Wald-method

(c) Level of significance *** p<0.001 ** p<0.01 * p<0.05

Table S5. Number of individuals and species caught per night by the three lamps.

	Mean	SD	Percentage	Sum of all samples	Shannon diversity	Simpson diversity
Individuals						
maxi	72.6	31.4	38.7 %	874		
mini	53.2	26.6	28.3 %	638		
UV	62.0	36.1	33.0 %	745		
Species						
maxi	27.1	7.3	34.6 %	118	3.849	0.962
mini	22.2	6.5	32.8 %	112	3.912	0.967
UV	22.7	7.4	32.6 %	111	3.749	0.957
Habitat 1					3.812	0.949
Habitat 2					3.668	0.949

Table S6. Multiple Post hoc comparison of means of the number of individuals and species caught by the lamps; Tukey contrast method (single step method). Significance level p < *** = 0.001; ** 0.01; * 0.05.

	exp (Estimate)	exp (Std. Error)	Z-Value	Pr(>|z|)[a]
Individuals				
mini - maxi	-0.34	0.09	-3.75	<0.001***
maxi - UV	-0.22	0.09	-2.45	0.038*
mini - UV	0.12	0.09	1.32	0.385
Species				
mini - maxi	-0.20	0.08	-2.49	0.024*
maxi - UV	-0.18	0.08	-2.47	0.06
mini - UV	0.20	0.09	0.24	0.968

Table S7. Percentage of males for all the species caught and for the largest three families. The χ2 independence test was used to examine the relationship between the observed percentages of the sexes and the lamp used. Significance level p < *** = 0.001; ** 0.01; * 0.05.

	χ^2	df	p-value
All lamps	0.42	2	0.892
Noctuidae	3.23	2	0.199
Geometridae	0.78	2	0.671
Erebidae	2.14	2	0.346

Table S8. Number of individuals and species in two habitats.

	Mean	SD	Total number
Number of individuals			
Habitat 1 orchard meadow	53.4	29.4	969
Habitat 2 dry grassland	71.6	32.3	1288
Number of species			
Habitat 1 orchard meadow	22.6	7.3	128
Habitat 2 dry grassland	25.3	7.1	120

Table S9. Number of individuals and percentages of the five commonest species in two habitats

	Individuals	Percentage		Individuals	Percentage
Habitat 1			**Habitat 2**		
orchard meadow			**dry grassland**		
Eilema lurideola	174	18.0 %	*Noctua fimbriata*	173	13.4 %
Agrotis exclamationis	60	6.1 %	*Eilema complana*	145	11.3 %
Idaea rufaria	54	5.6 %	*Noctua pronuba*	92	7.1 %
Noctua fimbriata	43	4.4 %	*Idaea dilutaria*	83	6.4 %
Oligia strigilis	39	4.0 %	*Oligia strigilis*	56	4.4 %

Table S10. Number of individuals and species caught at the exposed, moderately sheltered and sheltered sites.

	Mean	SD	Percentage	Total number
Individuals				
Sites 1 and 4 (exposed)	45.8	23.4	24.3 %	549
Sites 3 and 5 (moderately sheltered)	77.9	35.0	41.4 %	935
Sites 2 and 6 (sheltered)	64.4	29.6	34.2 %	773
Species				
Sites 1 and 4 (exposed)	19.2	5.3	62.1%	100
Sites 3 and 5 (moderately sheltered)	28.1	7.2	70.2%	119
Sites 2 and 6 (sheltered)	24.7	6.6	73.9%	113

Table S11. Multiple Post hoc comparison of means of the number of individuals and species caught by the different lamps; Tukey contrast method (single step method). Significance level p < *** = 0.001; ** 0.01; * 0.05.

	exp (Estimate)	exp (Std. Error)	Z-Value	Pr(>|z|)[a]
Individuals				
exposed - sheltered	0.34	0.12	2.91	0.010*
exposed – moderately sheltered	0.56	0.12	4.83	<0.001***
moderately sheltered – sheltered	0.22	0.11	1.95	0.126
Species				
exposed - sheltered	0.26	0.09	2.97	0.008**
exposed – moderately sheltered	0.39	0.08	4.60	<0.001***
moderately sheltered – sheltered	0.13	0.08	1.63	0.126

Table S12. Percentages of individuals caught at the exposed, moderately sheltered and sheltered sites.

	exposed	moderately sheltered	sheltered
maxi	50.3 %	35.8 %	34.0 %
mini	24.4 %	26.9 %	32.7 %
UV	25.3 %	37.3 %	33.3 %

See also S2 (separate Excel file) with raw data: list of individuals, site sampling data, species site matrix