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Koskenpato, K., Ahola, K., Karstinen, T. and Karell, P. 2015. Is the denser contour feather structure in pale grey than in pheomelanic brown tawny owls *Strix aluco* an adaptation to cold environments? – J. Avian Biol. doi: 10.1111/jav.00746

Supplementary material

Appendix 1

Analyses of feather structure in relation to colour polymorphism using ordinal 'Colour score' data instead of the factor 'Colour morph'

In the main results we used data consisting of 227 observations from 120 individuals. The main variable of interest – colouration – was scored in the field as an ordinal variable ranging from 4 to 14, where '4' is pale grey and '14' is dark reddish. The individuals were then categorized into a grey morph (scores 4-9) or brown morph (10-14). This categorization has been used previously and is based on the bimodal distribution of the data (see Brommer et al. 2005 and Karell et al. 2011a). The distribution of the data used in this publication is presented as a histogram in Fig. A1.

In the main results we used colour morph as explanatory variable (factor) in the linear mixed models analyzing the variation in feather structure in relation to colouration. We also run the same models where the categorical variable 'Colour morph' was replaced with the ordinal variable 'Colour score'. This replacement did not change the main conclusions as the variable 'Colour score' was significant in the same models as when 'Colour morph' was used. Below in Table A1 we present the most parsimonious models where colour score is the explanatory variable (comparable with models 4 and 5 in Table 2a and Table A2). All other models (model 1, 2, 3 in Table 2a and Table A2) in the main text were the same irrespective of whether 'Colour morph' or 'Colour score' was used as explanatory variable.

Table A2 presents the same results on feather structure variation as shown in Table 2a in the main text including a footnote with the removed variables below the table.

Supplementary references

Brommer, J.E., Ahola, K. and Karstinen, T. 2005. The colour of fitness: plumage coloration and lifetime reproductive success in the tawny owl. — Proc. Biol. Sci. 272: 935-940.

Karell, P., Ahola, K., Karstinen, T., Valkama, J. and Brommer, J.E. 2011a. Climate change drives microevolution in a wild bird. — Nat. Commun. 2: 208.

Table A1. The most parsimoneous linear mixed models on different feather traits. [Estimated direction and size of the effect and standard errors, DF = degrees of freedom, F = F-test value of the variable, p = p value]. Variable 'sex' is coded as male = 1, female = 2. The estimates of the variable 'year' are not shown.

Variable	**Estimate ± SE**	**DF**	**F**	**p**
Dorsal *plu.*barbules / mm				
Colour score	-0.34 ± 0.13	1,94	5.18	0.025
Year		7,94	3.99	0.001
Dorsal prop. of *plu.*barbs (%)				
Colour score	-0.34 ± 0.15	1,93	4.79	0.03
Feather length	1.54 ± 0.46	1,93	10.43	0.002
Year		7,93	3.65	0.002

Table A2. The most parsimoneous linear mixed models on different feather traits (Table 2a in the main text) listing the removed variables below the table. [Estimated direction and size of the effect and standard errors, DF = degrees of freedom, F = F-test value of the variable, p = p value]. Variable 'sex' is coded as male = 1, female = 2, and 'morph' as grey = 1, brown = 2. The estimates of the variable 'year' are not shown. None of the tested variables were significant in model 6 analyzing dorsal feather's *plu*.barbs / cm.

Variable	**Estimate ± SE**	**DF**	**F**	**p**
Model 1: Ventral *plu*.barbs / cm				
Sex	0.71 ± 0.30	1,118	6.75	0.01
Feather length	0.25 ± 0.16	1,96	6.45	0.01
Year		7,96	10.81	<.0001
Model 2: Ventral *plu*.barbules / mm				
Sex	1.18 ± 0.42	1,118	14.96	<.0001
Feather length	1.05 ± 0.24	1,96	29.74	<.0001
Year		7,96	5.83	<.0001
Model 3: Ventral prop. of *plu*.barbs (%)				
Feather length	-0.49 ± 0.27	1,94	11.90	<.0001
Age class		2,94	8.60	0.004
2-yr	0.54 ± 0.71			
3-yr and older	2.13 ± 0.59			
Year		7,94	2.75	0.01
Model 4: Dorsal *plu*.barbules / mm				
Colour morph	-1.87 ± 0.77	1,94	5.71	0.02
Year		7,94	3.84	0.001
Model 5: Dorsal prop. of *plu*.barbs (%)				
Colour morph	-2.08 ± 0.86	1,93	5.70	0.02
Feather length	1.55 ± 0.46	1,93	10.45	0.002
Year		7,93	3.63	0.002

Removed variables

Model 1: Morph * age class F2,91 = 0.59, P = 0.56, morph F1,93 = 0.10, P = 0.74, age class F2,94 = 1.86, P = 0.16.

Model 2: Morph * age class F2,91 = 0.75, P = 0.48, , morph F1,93 = 0.60, P = 0.44, , age class F2,94 = 3.01, P = 0.05.

Model 3: Morph * age class F2,91 = 0.84, P = 0.43, morph F1,93 = 0.001, P = 0.99, sex F1,118 =.1.49, P = 0.23.

Model 4: Morph * age class F2,89 = 0.07, P = 0.93, age class F2,91 = 0.19, P = 0.83, sex F1,116 = 2.39, P = 0.12, feather length F1,93 = 1.96, P = 0.16.

Model 5: Morph * age class F2,89 = 0.04, P = 0.96, sex F1,116 = 2.98, P = 0.09, age class F2,91 = 2.43, P = 0.09,

Model 6: Morph * age class F2,89 = 0.66, P = 0.52, sex F1,116 = 0.15, P = 0.70, feather length F1,91 = 1.28, P = 0.26, morph F1,92 = 1.33, P = 0.25, age class F2,93 = 2.04, P = 0.14, Year F7,95 = 1.62, P = 0.14.

Figure caption:

Figure A1. Histogram showing the number of observations (N = 227) of different individuals with different colour scores.