

Supporting Information

Appendix S5. Steps for our data analysis: Phylogenetic generalized least squares models, *separate for each sex*.

Response variables:

- Range size
- Latitudinal range
- Longitudinal range

~

Predictor variables:

- Morphological:
 - Fore- and hindwing centroid size
 - Fore- and hindwing ratio
 - Fore and hind pterostigma ratio
 - Fore- and hindwing shape (PC1, PC2, PC3)
- Ecological:
 - Migratory status (yes/no)
 - Larval habitat (lotic, lentic, both)
- Eco-geographical:
 - Mid-range latitude
 - Mid-range longitude

Step 1. Separate models for each predictor and response variables, in triplets: white-noise, Brownian motion (BM) and Ornstein–Uhlenbeck motion (OU)

*The components of wing shape (PC1, PC2 and PC3) were entered together.

e.g. migratory status as a predictor of range size:

- range size ~ migratory status, white-noise
- range size ~ migratory status, BM
- range size ~ migratory status, OU

Step 2. Predictor variable retained if:

a) significant for the most supported model(s) (based on $\Delta AICc < 2$).

AND

b) significant in the white-noise model.

Step 3. We combined the retained predictor variables for each response variable:

e.g. migratory status and hindwing shape PC1 for range size, in males

Step 4. Combined model run in triplets (white-noise, BM, OU), including all possible combinations and interactions of predictors.

*If collinearity was detected between predictors (variance inflation factor > 2), separate models were run.

e.g. range size ~ migratory status, white-noise
 range size ~ migratory status, BM
 range size ~ migratory status, OU
 range size ~ hindwing shape PC1, white-noise
 range size ~ hindwing shape PC1, BM
 range size ~ hindwing shape PC1, OU
 range size ~ migratory status + hindwing shape PC1, white-noise
 range size ~ migratory status + hindwing shape PC1, BM
 range size ~ migratory status + hindwing shape PC1, OU
 range size ~ migratory status * hindwing shape PC1, white-noise
 range size ~ migratory status * hindwing shape PC1, BM
 range size ~ migratory status * hindwing shape PC1, OU

If the interaction was not significant, it was removed from the final pool of models.

Model support was evaluated again based on $\Delta AICc < 2$ (results summarized in Tables 1 and 2 in the main text, and full results in Tables S2 and S3 in Appendix S3).