

**Supplementary material**

## Appendix 1

**Table A1** Data set of the current study for the family Apodidae from Chantler & Driessens (1995).

| Scientific name                | Wing length | Tail length <sup>†</sup> | Fork depth | Egg length | Egg breadth | Migrant or not | Clutch size |
|--------------------------------|-------------|--------------------------|------------|------------|-------------|----------------|-------------|
| <i>Hydrochous gigas</i>        | 150         | 61                       | 9          | 29         | 19          | 0              | 1           |
| <i>Collocalia esculenta</i>    | 104         | 41                       | 0          | 17         | 11          | 0              | 2           |
| <i>Collocalia unicolor</i>     | 115         | 51                       | 8          | 20         | 13          | 0              | 2           |
| <i>Collocalia mearnsi</i>      | 112         | 48                       | 5          | 24         | 14          | 0              | 4           |
| <i>Collocalia brevirostris</i> | 126         | 56                       | 9          | 21         | 14          | 0              | 2           |
| <i>Collocalia salangana</i>    | 124         | 53                       | 2          | 21         | 14          | 0              | 2           |
| <i>Collocalia maxima</i>       | 131         | 54                       | 7          | 23         | 16          | 0              | 1           |
| <i>Collocalia fuciphaga</i>    | 118         | 56                       | 8          | 20         | 13          | 0              | 2           |
| <i>Tachornis squamata</i>      | 106         | 71                       | 39         | 15         | 10          | 0              | 3           |
| <i>Cypsiurus parvus</i>        | 132         | 90                       | 58         | 19         | 12          | 0              | 2           |
| <i>Cypsiurus balasiensis</i>   | 118         | 64                       | 33         | 18         | 11          | 0              | 2           |
| <i>Tachymarptis melba</i>      | 221         | 80                       | 22         | 30         | 19          | 1              | 3           |
| <i>Apus apus</i>               | 173         | 74                       | 29         | 25         | 16          | 1              | 2           |
| <i>Apus unicolor</i>           | 155         | 69                       | 28         | 22         | 15          | 0              | 2           |
| <i>Apus niansae</i>            | 154         | 60                       | 20         | 23         | 14          | 1              | 2           |
| <i>Apus pallidus</i>           | 171         | 70                       | 25         | 25         | 16          | 1              | 2           |
| <i>Apus barbatus</i>           | 179         | 74                       | 24         | 25         | 16          | 1              | 1           |
| <i>Apus berliozzi</i>          | 165         | 66                       | 25         | 26         | 16          | 1              | 2           |
| <i>Apus bradfieldi</i>         | 172         | 73                       | 21         | 26         | 16          | 0              | 2           |
| <i>Apus pacificus</i>          | 177         | 79                       | 32         | 22         | 15          | 1              | 2           |
| <i>Apus acuticauda</i>         | 170         | 72                       | 23         | 26         | 16          | 1              | 2           |
| <i>Apus affinis</i>            | 136         | 40                       | 0          | 22         | 14          | 1              | 2           |
| <i>Apus nipalensis</i>         | 135         | 51                       | 6          | 23         | 15          | 0              | 3           |
| <i>Apus horus</i>              | 152         | 55                       | 11         | 23         | 15          | 0              | 2           |
| <i>Apus caffer</i>             | 139         | 69                       | 30         | 23         | 14          | 1              | 2           |
| <i>Apus batesi</i>             | 124         | 64                       | 23         | 22         | 14          | 0              | 2           |

<sup>†</sup>Outermost tail feather length.

**Table A2** Multivariable phylogenetic generalised least squares (PGLS) model for degree of elongation, i.e. length divided by breadth, with and without controlling for egg volume using female fork depth (both:  $N = 26$ ).

| Predictor                           | Coefficient $\pm$ SE | 95% CI            | $t$   | $p$  |
|-------------------------------------|----------------------|-------------------|-------|------|
| Without controlling for egg volume  |                      |                   |       |      |
| log(wing length)                    | $-0.02 \pm 0.02$     | $-0.06$ to $0.02$ | -1.03 | 0.31 |
| Tail fork depth                     | $0.01 \pm 0.01$      | $-0.02$ to $0.04$ | 0.64  | 0.53 |
| Migrant or not                      | $0.06 \pm 0.04$      | $-0.02$ to $0.13$ | 1.62  | 0.12 |
| <i>Model averaged lambda = 0.07</i> |                      |                   |       |      |
| With controlling for egg volume     |                      |                   |       |      |
| log(wing length)                    | $-0.05 \pm 0.03$     | $-0.11$ to $0.02$ | -1.55 | 0.14 |
| Tail fork depth                     | $0.02 \pm 0.02$      | $-0.02$ to $0.05$ | 1.01  | 0.33 |
| Migrant or not                      | $0.07 \pm 0.04$      | $-0.01$ to $0.14$ | 1.90  | 0.07 |
| Egg volume                          | $0.03 \pm 0.03$      | $-0.02$ to $0.08$ | 1.21  | 0.24 |
| <i>Model averaged lambda = 0.18</i> |                      |                   |       |      |

Model-averaged coefficient, standard error (SE) and 95% confidence intervals (CIs) are shown. For easy interpretation, we also added model-averaged  $t$ -value and  $p$ -value. All variables were standardised to zero mean and unit variance. Significant test (i.e. 95% CI does not contain zero) results are indicated in bold. Model-averaged VIFs were 1.95 and 6.12, respectively. The quadratic term of tail fork

depth, if added to the models, was far from significant (both:  $p > 0.10$ ).

**Table A3** Trait expression in swifts and swallows used for the analysis.

| Variable  | Swallows<br>( <i>N</i> = 65) |     | Swifts<br>( <i>N</i> = 26) |
|---|------------------------------|-----|----------------------------|
| Wing length (mm)                                | 109.66 ± 13.25               | *** | 144.57 ± 28.21             |
| Central tail length (mm)                        | 44.21 ± 5.58                 |     | 44.08 ± 6.49               |
| Wing:tail ratio                                 | 2.50 ± 0.27                  | *** | 3.30 ± 0.54                |
| Relative tail fork depth <sup>†</sup>           | 0.37 ± 0.35                  |     | 0.47 ± 0.42                |
| Egg length (mm)                                 | 18.91 ± 1.84                 | *** | 22.69 ± 3.43               |
| Egg breadth (mm)                                | 13.15 ± 1.19                 | *** | 14.54 ± 2.14               |
| Egg volume (10 <sup>3</sup> × mm <sup>3</sup> ) | 17.10 ± 5.10                 | *** | 25.97 ± 11.22              |
| Clutch size                                     | 4.48 ± 1.06                  | *** | 2.08 ± 0.63                |

Values are depicted as mean ± standard deviation.

<sup>†</sup>Relative fork depth was calculated as (fork depth)/(central tail feather length).

\*\*\* *p* < 0.001 (Mann–Whitney *U*-test).

**Figure A1.** The majority-rule consensus phylogenetic tree of the current data set from the family Apodidae derived from the “consensus” function in the R package “ape” using 1000 trees obtained from birdtree.org (see “Materials and Methods” for detailed information).

