**Supplementary Figure 1.** Measuring reproductive thermal performance. A) Procedures and schedule of measurements. B) Change in fecundity from 1st – 2nd day to 7th – 8th day at different temperatures. BIP = *D. bipectinata*, BIR = *D.birchii*, BUN = *D. bunnanda*, PAL = *D. pallidifrons*, PAN = *D. pandora*, PSA = *D. pseudoananassae*, SIM = *D. simulans*, SUL = *D. sulfurigaster*.

A)

A screenshot of a cell phone

Description automatically generated

B)

Chart, line chart

Description automatically generated

**Supplementary Figures 2.** Diagnostics of fitted thermal performance curves. A) Comparison of observed and fitted values of fecundity. B) Residuals and standardized residuals plot. C) Observed daily fecundity (points) and fitted thermal performance curve (blue line) for each of the nine species.

A)

Chart

Description automatically generated

B)

Chart, scatter chart

Description automatically generated

C)

A picture containing chart

Description automatically generated

**Supplementary Figures 3.** A) The phylogenetic tree of all *Drosophila* species mentioned in this study. B) The ultrametric phylogenetic tree of the seven species used in the regression analysis of thermal traits. C) The process to create the ultrametric tree from the DrosoPhyla dataset (Finet et al., 2021).

Diagram

Description automatically generated

**Supplementary Figure 4.** Field and experimental temperatures of lowland (A) and upland (B) at Kirrama and Paluma on February 2017. Each gray line shows the hourly temperature of one day. The blue lines show the average temperature recorded at the time of the day for the specified month. Temperature regimes used in short-term and long-term competition experiments are indicated by red lines, mimicking the day/night fluctuation of temperatures in the field.

Chart, histogram

Description automatically generated

**Supplementary Figure 5.** Diagnostics of the fitted model for short-term competition (Beverton-Holt model) in the cool, upland (A) and warm, lowland (B) treatments, comparing the observed offspring counts and the fitted values. (C) Comparison of the observed population size and the fitted values from the regression for the long-term competition experiment.

A)

A picture containing diagram

Description automatically generated

B)

A picture containing text

Description automatically generated

C)

Chart

Description automatically generated

**Supplementary Figure 6.** A) *RTopt* of each *Drosophila* species ordered by *hIndex*. B) Posterior distribution of *RTmaxs* and *RTmins* of each *Drosophila* species’ thermal performance curve.

A)

Chart, box and whisker chart

Description automatically generated

B)

Chart, scatter chart

Description automatically generated

**Supplementary Figure 7.** A) Average of daily maximum temperature in each month. B) Average hours per day that the temperature exceeds 29°C, a stressful temperature for reproduction, in each month. A known stressful temperature, 29°C, is indicated by the horizontal dark red line. Blue, green and red colours indicate sites at high, medium and low elevations, respectively. Solid and dashed lines represent sites at Kirrama and Paluma, respectively.

Chart, line chart, histogram

Description automatically generated

**Supplementary Table 1.** Isofemale lines used to construct mass bred lines of the rainforest *Drosophila* species.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Species | Origin of cultured lines (yes/no) | | | | Lines for mass bred lines |
| K low1 | K high1 | P low1 | P high1 |
| *D. bunnanda* | yes | no | yes | no | KL87, KL134, KL127, PL114 |
| *D. pandora* | no | no | yes | no | PL17, PL21, PL012 |
| *D. bipectinata* | yes | no | yes | no | KL84, KL43, PL85, PL20 |
| *D. pseudoananassae* | yes | yes | yes | no | KL19, KH25, PL30, KH42 |
| *D. sulfurigaster* | yes | yes | yes | yes | KL08, KH10, PL51, PH18 |
| *D. rubida* | yes | yes | yes | yes | Construction unfinished3. |
| *D. birchii* | yes | yes | yes | yes | KL22, KH26, PL122, PH169 |
| *D. pallidifrons* | no | yes | no | yes | KH20, KH69, PH183, PH184 |
| *D. simulans* | no | no | yes | no | PL45, PL34, PL42, PL43 |
| *D. pseudotakahashii* | no | yes | no | yes | Contamination4 |

Note:

1. “K” stands for Kirrama Range. “P” stands for Paluma Range. “low” and “L” means sites from low elevation. “high” and “H” means sites from high elevation.
2. Only these three isofemale lines were available.
3. Construction was not finished by the start of the thermal performance experiment in May. *Drosophila rubida* grew poorly on the fly medium, and had significantly longer generation time than other species.
4. Because of contamination in isofemale lines, mass bred lines of D. pseudotakahashii was not available by the time of measuring thermal traits. Two isofemale lines were not contaminated and they were used to construct mass bred population for the later competition experiments.

**Supplementary Table 2.** Distribution patterns quantified by *hIndex* and by the effect (coefficient) of elevation on the likelihood of detecting each species. The effects of transect and the elevation X transect interaction are also included except for *D. bunnanda*, *D. pandora*, and *D.pseudotakahashii*, where it was not possible to include the interaction term and/or the transect term because of very skewed distributions (very few observations at one elevation in either or both mountain range).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ***hIndex*** | **Species** | **Factor** | **Coefficient** | **P value** |
| 0 | *D. bunnanda* | elevation | -64 | 0.99 |
| 0.07 | *D. pandora* | **elevation** | **-7.8** | **0.0017** |
| 0.12 | *D. bipectinata* | **elevation** | **-3.05** | **0.02** |
|  |  | transect | 1.83 | 0.001 |
|  |  | **elevation\*transect** | **-6.22** | **0.02** |
| 0.40 | *D. pseudoananassae* | elevation | -0.53 | 0.22 |
|  |  | transect | 0.18 | 0.60 |
|  |  | **elevation\*transect** | **-4.82** | **<0.001** |
| 0.43 | *D. rubida* | elevation | -0.77 | 0.056 |
|  |  | transect | -0.29 | 0.29 |
|  |  | elevation\*transect | 0.64 | 0.22 |
| 0.54 | *D. sulfurigaster* | elevation | -0.91 | 0.54 |
|  |  | transect | 0.11 | 0.90 |
|  |  | elevation\*transect | -0.01 | 0.99 |
| 0.64 | *D. birchii* | elevation | 1.24 | 0.27 |
|  |  | transect | 0.40 | 0.62 |
|  |  | elevation\*transect | -0.94 | 0.51 |
| 0.76 | *D. pallidifrons* | **elevation** | **2.90** | **<0.001** |
|  |  | transect | 0.44 | 0.39 |
|  |  | elevation\*transect | -0.54 | 0.51 |
| 1 | *D. pseudotakahashii* | **elevation** | **12.5** | **<0.001** |

**Supplementary Table 3.** Pairwise comparison (Tukey test) of knockdown time by cold temperature for the nine *Drosophila* species.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Difference** | **ci\_lower** | **ci\_upper** | **Adjusted p value** |
| BIR-BIP | -0.2857143 | -1.2871803 | 0.71575178 | 0.99338903 |
| BUN-BIP | -0.1190476 | -1.1205137 | 0.88241844 | 0.99998982 |
| **MEL-BIP** | **7.28571429** | **6.28424822** | **8.28718035** | **0** |
| PAL-BIP | -0.1428571 | -1.1443232 | 0.85860892 | 0.99995836 |
| PAN-BIP | 0.64285714 | -0.3586089 | 1.6443232 | 0.54218782 |
| PSA-BIP | -0.3333333 | -1.3347994 | 0.66813273 | 0.98184092 |
| **SIM-BIP** | **5.07142857** | **4.06996251** | **6.07289463** | **0** |
| SUL-BIP | -0.547619 | -1.5490851 | 0.45384701 | 0.74241446 |
| BUN-BIR | 0.16666667 | -0.8347994 | 1.16813273 | 0.99986522 |
| **MEL-BIR** | **7.57142857** | **6.56996251** | **8.57289463** | **0** |
| PAL-BIR | 0.14285714 | -0.8586089 | 1.1443232 | 0.99995836 |
| PAN-BIR | 0.92857143 | -0.0728946 | 1.93003749 | 0.09367333 |
| PSA-BIR | -0.047619 | -1.0490851 | 0.95384701 | 0.99999999 |
| **SIM-BIR** | **5.35714286** | **4.3556768** | **6.35860892** | **0** |
| SUL-BIR | -0.2619048 | -1.2633708 | 0.7395613 | 0.99635753 |
| **MEL-BUN** | **7.4047619** | **6.40329584** | **8.40622797** | **0** |
| PAL-BUN | -0.0238095 | -1.0252756 | 0.97765654 | 1 |
| PAN-BUN | 0.76190476 | -0.2395613 | 1.76337082 | 0.30147732 |
| PSA-BUN | -0.2142857 | -1.2157518 | 0.78718035 | 0.99912764 |
| **SIM-BUN** | **5.19047619** | **4.18901013** | **6.19194225** | **0** |
| SUL-BUN | -0.4285714 | -1.4300375 | 0.57289463 | 0.92008645 |
| **PAL-MEL** | **-7.4285714** | **-8.4300375** | **-6.4271054** | **0** |
| **PAN-MEL** | **-6.6428571** | **-7.6443232** | **-5.6413911** | **0** |
| **PSA-MEL** | **-7.6190476** | **-8.6205137** | **-6.6175816** | **0** |
| **SIM-MEL** | **-2.2142857** | **-3.2157518** | **-1.2128197** | **8.26E-10** |
| **SUL-MEL** | **-7.8333333** | **-8.8347994** | **-6.8318673** | **0** |
| PAN-PAL | 0.78571429 | -0.2157518 | 1.78718035 | 0.2613271 |
| PSA-PAL | -0.1904762 | -1.1919423 | 0.81098987 | 0.99963326 |
| **SIM-PAL** | **5.21428571** | **4.21281965** | **6.21575178** | **0** |
| SUL-PAL | -0.4047619 | -1.406228 | 0.59670416 | 0.94170483 |
| PSA-PAN | -0.9761905 | -1.9776565 | 0.02527558 | 0.06263078 |
| **SIM-PAN** | **4.42857143** | **3.42710537** | **5.43003749** | **0** |
| **SUL-PAN** | **-1.1904762** | **-2.1919423** | **-0.1890101** | **0.00732748** |
| **SIM-PSA** | **5.4047619** | **4.40329584** | **6.40622797** | **0** |
| SUL-PSA | -0.2142857 | -1.2157518 | 0.78718035 | 0.99912764 |
| **SUL-SIM** | **-5.6190476** | **-6.6205137** | **-4.6175816** | **0** |