Supplementary online material

for

Thermal performance across levels of biological organization

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Contents

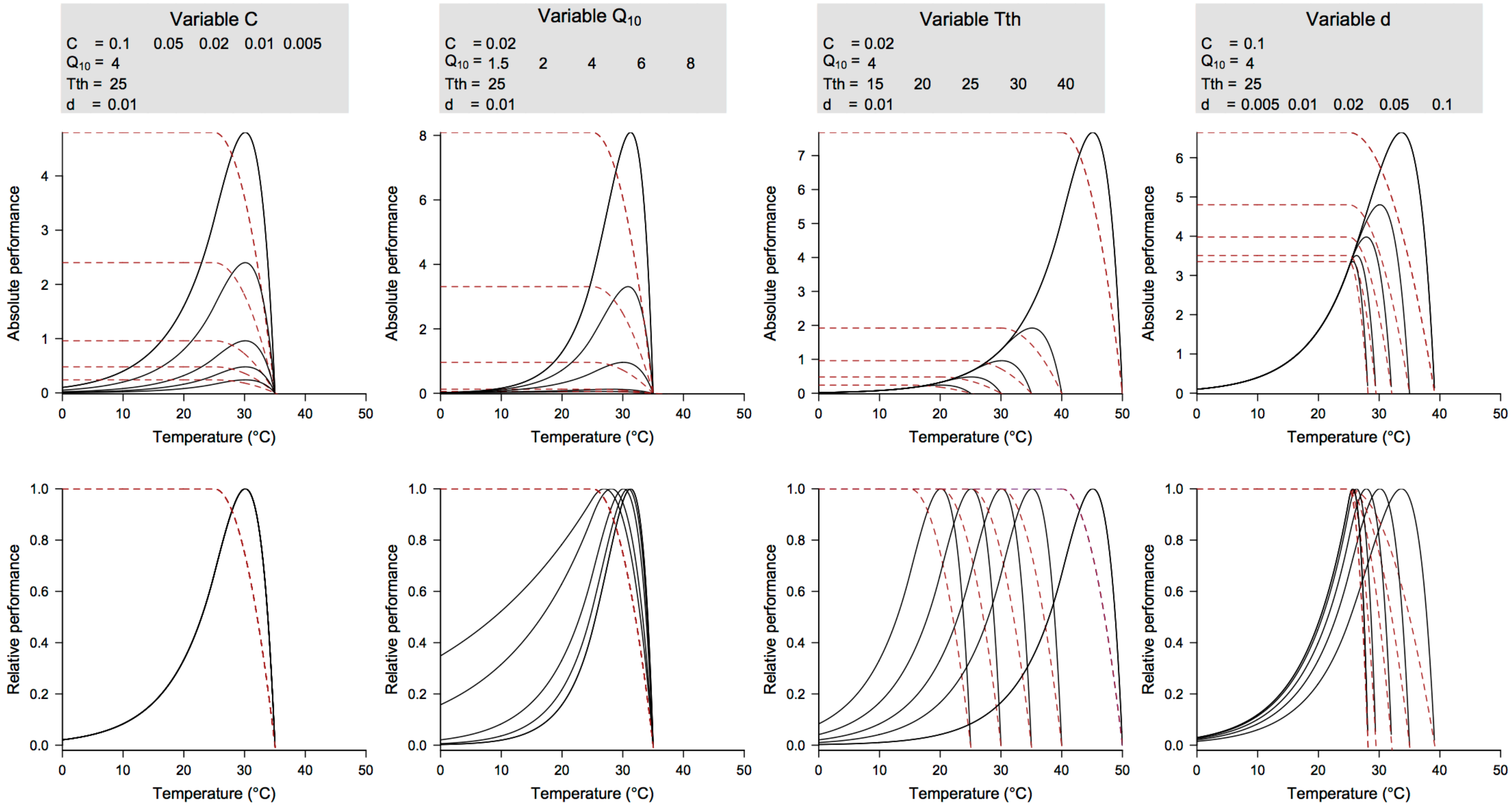

Figure S1. How each parameter in our model (see main text, eqn 3) affects the overall shape of the thermal performance curve can be studied by changing a single parameter at a time and maintaining everything else constant. Top and bottom panels show the same curve expressed in absolute units or as performance relative to the maximum set to 1.

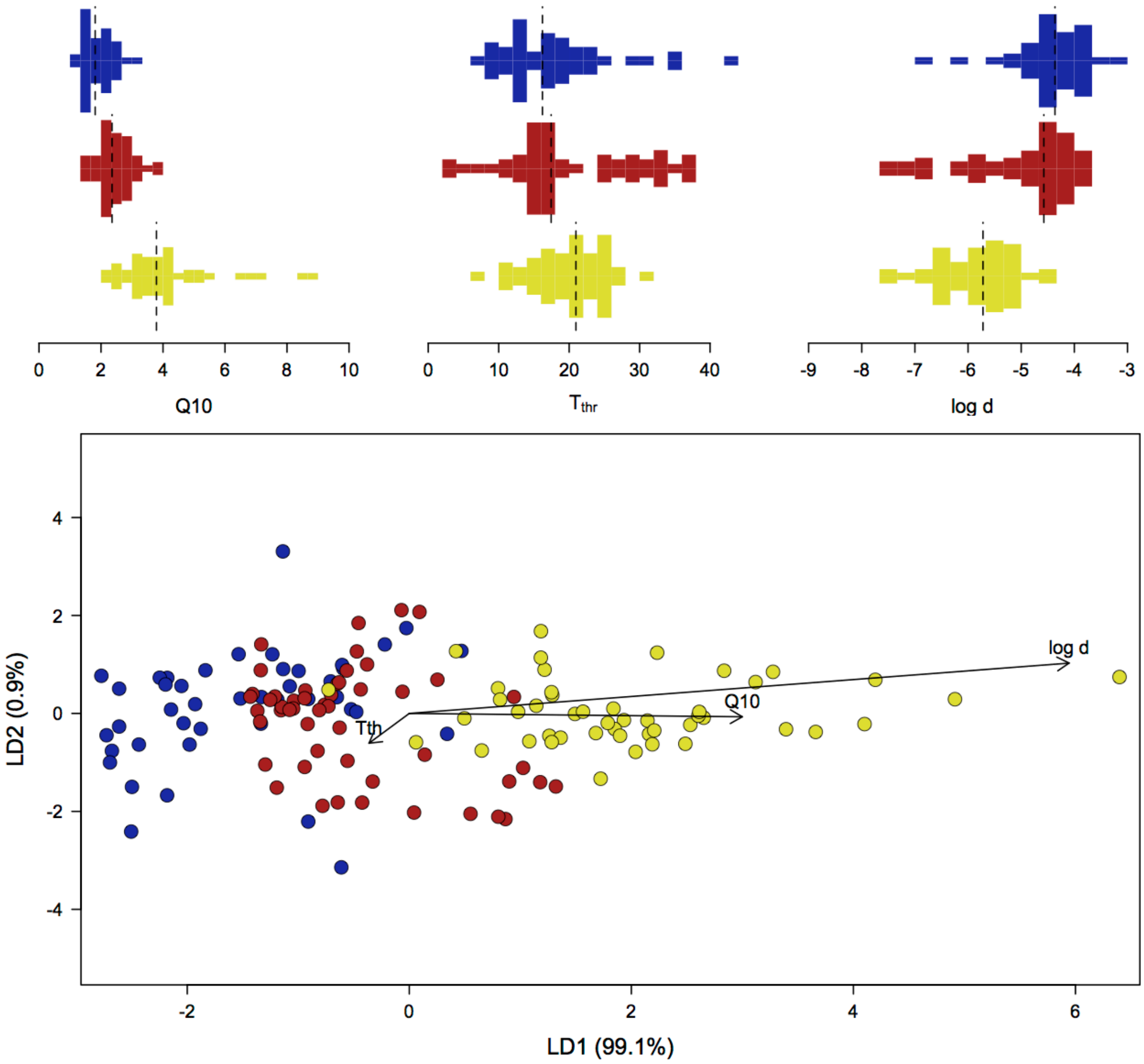

Figure S2. Results from discriminant analysis including parameters Q_{10}, d and T_{th} to determine how curves obtained for photosynthetic rates (blue), running speed (red) and intrinsic rates of increase (yellow) might differ from one another (parameter C was not included because it has no effect on the overall shape of the curve; see Fig. S1). Note that Q_{10} and d vary in tandem with higher values resulting in curves with narrower thermal ranges.

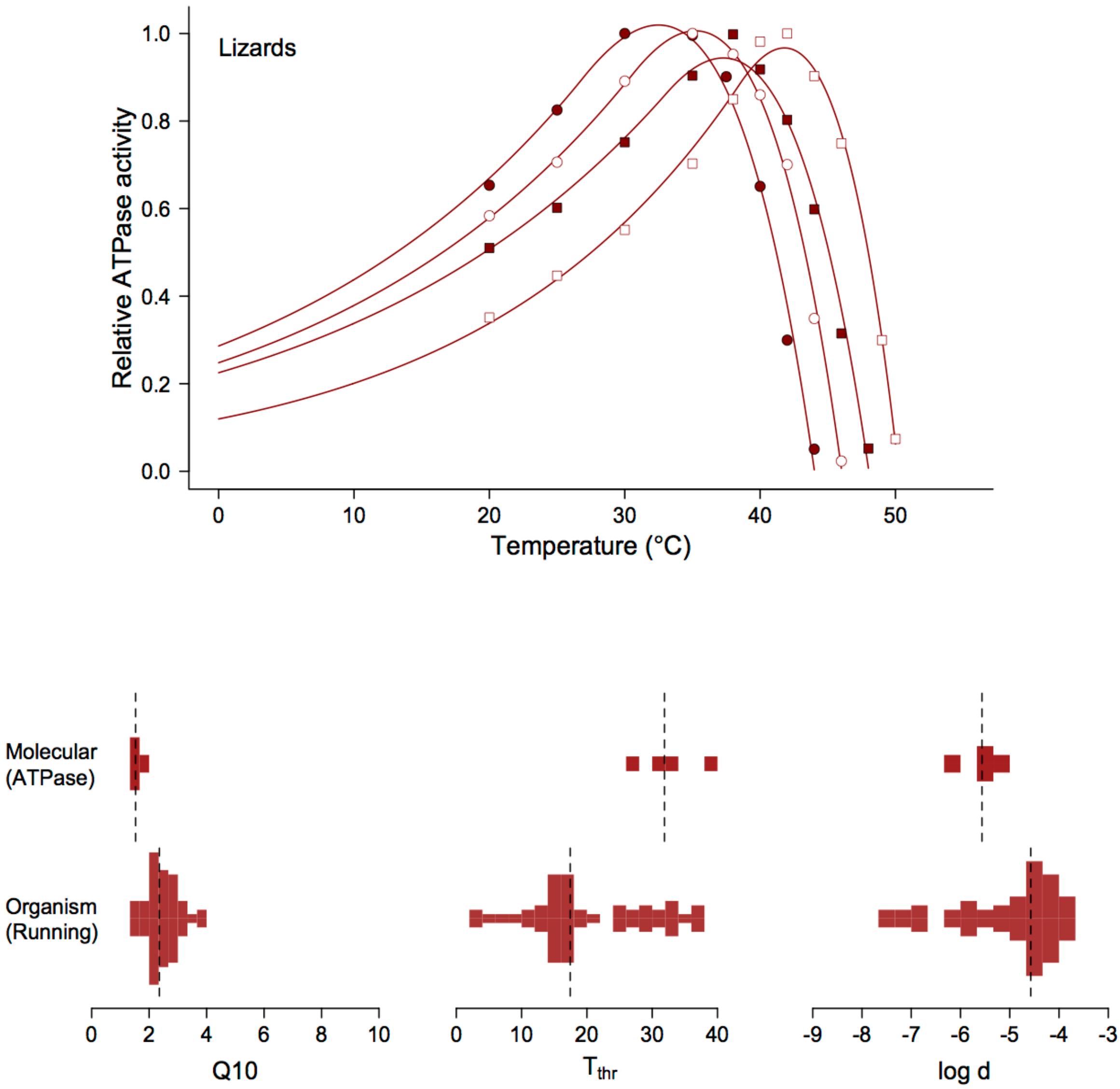

Figure S3. Calculation of parameters Q_{10}, d and T_{th} for thermal performance curves on enzymatic activity reported for four species of lizards (n = 4, curve fit R^2 = 0.991 ± 0.004 SD), and comparison against parameters estimated for running performance. Note that these enzymatic activity curves exhibit a higher $T_{breadth}$ than running performance (Fig. 4 in main text) primarily because Q_{10} is lower at this level of organization (Welch's unequal variances t-test, t = 10.3, df = 35.1, P = 4.0 × 10^{-12}). Consequently, significant differences across levels of organization are also observed within a single taxonomic group. Data from Licht 1967 (see main text).

Appendix A

Table A1. Photosynthetic rates in plants as a function of ambient temperature (dataset *Biochemistry_raw_data*.txt). Acclimation temperatures are provided within parenthesis with the species ID when multiple curves were reported.

Species	Ambient Temperature (ºC)	Performance (nmol cm^{-2} s^{-1})	Reference
Tidestromia oblongifolia	ta = 16.7, 18, 20, 22, 27.5, 31, 32.3, 42, 46, 49, 52	pf = 0.72, 0.87, 1.08, 1.3, 1.9, 2.33, 2.51, 3.57, 3.65, 3.56, 3.05	Berry & Bjorkman1980
Atriplex glabriuscula	ta = 10.9, 15.3, 20.8, 25.4, 34.9, 39.9, 42.6	pf = 0.61, 0.78, 1.27, 1.38, 1.3, 1.01, 0.77	Berry & Bjorkman1980
Atriplex sabulosa	ta = 13.1, 16.8, 20.8, 25.9, 30.9, 36, 40.8, 44.9	pf = 2.2, 2.83, 3.34, 3.72, 3.8, 3.65, 3.1, 1.2	Berry & Bjorkman1980
Atriplex sabulosa	ta = 11.7, 15.7, 19.8, 24.9, 29.9, 35.3, 40.1, 45	pf = 0.56, 0.71, 0.91, 1.22, 1.47, 1.59, 1.49, 0.6	Berry & Bjorkman1980
Tidestromia oblongifolia	ta = 16.5, 23.3, 28.1, 31.9, 36.8, 41.1	pf = 0.44, 0.83, 0.98, 0.96, 0.75, 0.35	Berry & Bjorkman1980
Tidestromia oblongifolia	ta = 13.9, 17.5, 21.5, 24.9, 28, 32.1, 34.9, 40.7, 42.3, 44.9, 46.9, 48.5, 49.6, 51.1	pf = 0.68, 1.26, 1.94, 2.6, 3.15, 3.94, 4.6, 5.36, 5.46, 5.47, 5.26, 4.87, 4.53, 3.97	Berry & Bjorkman1980
Atriplex lentiformis	ta = 10.2, 11.9, 13.7, 15.9, 18, 19.7, 22, 23.7, 25.7, 27.6, 29.6, 32.1, 34.2, 38, 42.7, 45.3, 47.1	pf = 0.47, 0.6, 0.69, 0.87, 1.02, 1.17, 1.46, 1.74, 2.01, 2.24, 2.41, 2.62, 2.81, 3.1, 3.09, 2.9, 2.32	Berry & Bjorkman1980
Nerium oleander	ta = 10.6, 14.9, 19.5, 22.9, 25.9, 29.5, 34.9, 38.6, 42.6, 44.7	pf = 1.18, 1.53, 1.81, 1.87, 1.89, 1.9, 1.76, 1.52, 1.18, 0.54	Berry & Bjorkman1980
Larrea divaricata	ta = 15.7, 20.8, 24.8, 29.8, 34.6, 39.7, 44.9, 48.6	pf = 1.92, 2.22, 2.3, 2.3, 2.32, 1.96, 1.13, 0.07	Berry & Bjorkman1980
Larrea divaricata	ta = 16.3, 20.7, 24.4, 27.8, 33.9, 38.6, 40.8, 44.2, 48.3, 49.8	pf = 1.11, 1.48, 1.72, 2.01, 2.26, 2.33, 2.28, 2.12, 1.62, 1.38	Berry & Bjorkman1980
Nerium oleander (20ºC)	ta = 11.2, 15.4, 20, 23.7, 30.3, 35.1, 39.2, 41.6, 43, 45.4	pf = 1.18, 1.55, 1.81, 1.85, 1.85, 1.75, 1.52, 1.34, 1.18, 0.55	Berry & Bjorkman1980

Nerium oleander (45ºC)	ta = 13.6, 18.6, 20, 23, 27.9, 31.8, 35.5, 40.1, 41.1, 42, 43.2, 44.1, 45.2, 46.1, 47, 47.9, 49, 49.9	Berry & Bjorkman1980
	pf = 0.69, 1.06, 1.17, 1.48, 2.04, 2.55, 3.07, 3.76, 3.85, 3.91, 3.97, 3.98, 3.99, 3.96, 3.83, 3.55, 2.85, 1.28	
Nerium oleander (45ºC)	ta = 13.4, 19.3, 19.9, 22.6, 27, 31.5, 35.5, 39.5, 41.9, 48.9	Berry & Bjorkman1980
	pf = 0.59, 0.98, 0.99, 1.19, 1.47, 1.64, 1.68, 1.66, 1.56, 1.06	
Hordeum vulgare (15ºC)	ta = 15, 20, 25, 30, 35	Bunce 2000
	pf = 4.01, 5.02, 5.61, 5.51, 3.7	
Vicia faba (15ºC)	ta = 15, 20, 25, 30, 35	Bunce 2000
	pf = 3.01, 3.81, 4.32, 4.21, 2.99	
Chenopodium album (25ºC)	ta = 15, 20, 25, 30, 35	Bunce 2000
	pf = 2.22, 2.92, 3.22, 3.31, 2.8	
Lycopersicon esculetum (25ºC)	ta = 15, 20, 25, 30, 35	Bunce 2000
	pf = 1.4, 2.39, 3.19, 4.01, 3.79	
Glycine max (25ºC)	ta = 15, 20, 25, 30, 35	Bunce 2000
	pf = 1.4, 2.29, 3.39, 4.09, 3.88	
Abutilon theophrasti (25ºC)	ta = 15, 20, 25, 30, 35	Bunce 2000
	pf = 1.7, 2.88, 3.7, 4.5, 4.38	
Embothrium coccineum	ta = 10, 15, 20, 25, 30, 35	Castro-Arevalo EA 2008
	pf = 0.55, 0.79, 1.28, 1.39, 1.65, 1.45	
Cercis canadensis	ta = 20, 25, 30, 35, 40, 45	Griffin EA 2004
	pf = 1.19, 1.61, 2.12, 2.61, 2.89, 1.51	
Muhlenbergia glomerata (14ºC)	ta = 5, 10, 15, 20, 25, 30, 35	Kubien & Sage 2004
	pf = 0.28, 0.55, 0.87, 1.2, 1.61, 1.49, 1.03	
Muhlenbergia glomerata (26ºC)	ta = 5, 10, 15, 20, 25, 30, 35	Kubien & Sage 2004
	pf = 0.32, 0.61, 1.02, 1.43, 2.15, 2.42, 2.27	
Larrea divaricata (20ºC)	ta = 16.7, 20.8, 21.3, 25.7, 29.6, 30.2, 34.2, 35.3, 39.3, 40.5, 43.3, 45.2, 47.4, 50.5, 51.4	Mooney EA 1978
	pf = 2.97, 3.84, 3.86, 4.49, 5.08, 5.14, 5.45, 5.62, 5.45, 4.85, 4.81, 2.72, 3.12, 1.69, 1.21	
Larrea divaricata (35ºC)	ta = 16.8, 21, 24.4, 28.3, 31.5, 32.1, 35, 35.7, 39.6, 41.9, 42.2, 46.2, 48.9, 51.2	Mooney EA 1978
	pf = 2.12, 2.82, 3.43, 4.1, 4.86, 4.95, 5.64, 5.67, 6.05, 6.08, 5.99, 4.63, 3.53, 2.68	
Larrea divaricata (45ºC)	ta = 19, 22.4, 26.5, 31, 35.4, 40.2, 40.2, 44.2, 45, 46.7, 48.8, 51.1, 53.5	Mooney EA 1978
	pf = 1.91, 2.56, 3.06, 3.87, 4.78, 5.46, 5.67, 5.89, 6.29, 5.71, 5.17, 3.73, 2.41	
Ipomoea batatas	ta = 9.9, 11.6, 15, 16, 17, 20, 20, 20, 20.4, 20.7, 23.9, 25, 24.9, 25.2, 25, 29.9, 29.9, 29.5, 29.9, 34, 35.1, 33.9, 33.9, 38.1, 37.5, 39.9	Sage & Kubien 2007
	pf = 0.38, 0.59, 1, 1.2, 1.33, 1.52, 1.62, 1.88, 1.69, 1.73, 2.1, 2.15, 2.2, 2.27, 2.33, 2.43, 2.48, 2.54, 2.66, 2.43, 2.52, 2.56, 2.72, 2.36, 2.2, 1.96	
Muhlenbergia richardsonis	ta = 6.3, 9.6, 13.4, 17.7, 22, 24.3, 26.4, 30, 31.9, 34.9	Sage EA 2011 Fig1
	pf = 0.41, 1.11, 1.61, 2.48, 3.65, 4.42, 4.68, 5, 5.01, 5.33	

Carex helleri	ta = 7.8, 9.8, 14.7, 18.5, 22.4, 26.5, 27.2, 30.8, 33.5	Sage EA 2011 Fig1
	pf = 0.97, 1.32, 1.74, 2.1, 1.93, 2.37, 2.37, 2.3, 2.22	
Atriplex patula (15ºC)	ta = 3.6, 4.9, 5.6, 8.5, 10.2, 11.6, 13.3, 15.3, 16.9, 18.7, 20.5, 22.5, 24.6, 26.4	Sage EA 2011 Fig1
	pf = 0.76, 1.05, 1.45, 1.77, 2.18, 2.47, 2.76, 2.98, 3.02, 3.05, 3.08, 3.08, 3.05, 2.98	
Atriplex rosea (15ºC)	ta = 5.2, 6, 7.1, 9.1, 10.9, 11.9, 14.6, 15.4, 17.6, 19.2, 20.9, 23.3, 26.4, 28.7	Sage EA 2011 Fig1
	pf = 0.44, 0.49, 0.76, 0.96, 1.17, 1.33, 1.72, 1.92, 2.43, 2.78, 3.01, 3.27, 3.52, 3.6	
Atriplex patula (36ºC)	ta = 3.6, 5.3, 7.8, 9, 9.7, 11.2, 11.8, 13.7, 14.2, 15.6, 16.4, 17.9, 19.6, 22.1, 24.7, 27.2, 29.1	Sage EA 2011 Fig1
	pf = 0.38, 0.51, 0.64, 0.81, 0.86, 1, 1.04, 1.22, 1.29, 1.42, 1.48, 1.66, 1.79, 1.91, 1.96, 2.01, 2.02	
Atriplex rosea (30ºC)	ta = 11.3, 13.8, 15.5, 17.7, 19.1, 21.9, 23, 25.4, 27.5, 29.8	Sage EA 2011 Fig1
	pf = 0.54, 0.75, 0.95, 1.22, 1.51, 1.64, 2.07, 2.51, 2.85, 3.16	
Flaveria trinervia	ta = 15, 20, 25, 30, 35, 40	Sage EA 2011 Fig1
	pf = 1.73, 2.56, 3.09, 3.48, 3.56, 3.42	
Flaveria trinervia	ta = 20, 25, 27.5, 30, 32.5, 35, 37.5	Sage EA 2011 Fig1
	pf = 2.19, 2.92, 3.23, 3.52, 3.73, 3.94, 3.85	
Flaveria cronquistii	ta = 20, 22.5, 25, 27.5, 30, 32.5, 35, 37.5, 40	Sage EA 2011 Fig1
	pf = 1.75, 1.89, 2.03, 2.08, 2.14, 2.08, 1.96, 1.67, 1.41	
Chenopodium album	ta = 7.9, 9.6, 10.6, 14.4, 20.6, 23.4, 25.6, 27.4, 29.4, 31, 32, 33.8, 35.3, 36.7, 38, 38.1, 42, 43.2	Sage EA 2011 Fig2b
	pf = 0.9, 0.86, 1.45, 1.76, 2.47, 2.7, 2.73, 2.94, 2.94, 2.83, 3.09, 2.78, 3.24, 2.78, 2.83, 2.71, 2.88, 2.22	
Spartina townsendii	ta = 5, 10, 15, 20, 25, 30, 35.1, 40.1	Sage EA 2011 Fig3
	pf = 0.37, 0.8, 1.59, 2.15, 2.51, 2.75, 2.15, 0.23	
Agropyron smithii	ta = 9.3, 12, 14.9, 19.9, 24.7, 29.8, 34.8, 37.3, 39.7, 40.8, 42.4, 44.9, 47.5, 50	Monson EA 1982 Fig1
	pf = 2.19, 2.73, 3.19, 3.74, 4.17, 4.53, 4.83, 4.72, 4.78, 4.71, 4.64, 4.34, 3.88, 2.84	
Agropyron smithii	ta = 9.4, 12.5, 14.9, 20, 24.9, 29.9, 34.9, 39.9, 41.6, 43.9, 45, 47.1, 49.9	Monson EA 1982 Fig1
	pf = 2.13, 2.48, 2.82, 3.23, 3.65, 3.78, 3.62, 3.52, 3.34, 3, 2.35, 1.92, 1.12	
Capsicum annuum	ta = 8, 12.2, 16.3, 20.5, 24.5, 28.3, 32.7, 36.6	Sage & Sharkey1987 Fig1
	pf = 0.92, 1.65, 2.48, 3.14, 3.5, 3.87, 4.45, 4.85	
Lycopersicon esculentum	ta = 9.1, 12, 16.2, 20.4, 24.2, 28.2, 32.3	Sage & Sharkey1987 Fig1
	pf = 1.52, 1.91, 2.66, 3.81, 5.28, 5.56, 5.78	
Scrophularis desertorum	ta = 3.7, 8.9, 12.9, 16.5, 20.4, 24.5, 28.5, 34	Sage & Sharkey1987 Fig1
	pf = 1.35, 2.19, 2.88, 3.95, 4.5, 4.55, 4.54, 4.22	

References:

Berry, J. and Björkman, O. (1980) Photosynthetic response and adaptation to temperature in higher plants, Annu Rev Physiol. 31: 491–543.

Bunce, J. A. (2000) Acclimation of photosynthesis to temperature in eight cool and warm climate herbaceous C3species: Temperature dependence of parameters of a biochemical photosynthesis model. Photosynthesis Research 63: 59–67.

Castro-Arévalo, M. et al. (2008) Effects of low temperature acclimation on photosynthesis in three chilean proteaceae. Revista Chilena de Historia Natural 81: 321–333.

Griffin, J. J., Ranney, T. G. and Pharr, D. M. (2004) Heat and drought influence photosynthesis, water relations, and soluble carbohydrates of two ecotypes of redbud (*Cercis canadensis*). J. Am. Soc. Horticultural Sci. 129: 497–502.

Kubien, D. S. and Sage, R. F. (2004) Dynamic photo-inhibition and carbon gain in a C4 and a C3 grass native to high latitudes. Plant, Cell and Environment, 27: 1424–1435.

Monson, R. K. et al. (1982) Temperature dependence of photosynthesis in *Agropyron smithii*. Plant Physiology, 69: 929–934.

Mooney, H. A., Bjorkman, O. and Collatz, G. J. (1978) Photosynthetic acclimation to temperature in the desert shrub, *Larrea divaricata*: I. Carbon dioxide exchange characteristics of intact leaves. Plant Physiology, 61: 406–410.

Sage, R. F., Kocacinar, F. and Kubien, D. S. (2011) C4 Photosynthesis and temperature. Chapter 10 in Raghavendra, A. S. and Sage, R. F. (eds) C4 Photosynthesis and Related CO_2 Concentrating Mechanisms. Dordrecht: Springer Netherlands, pp. 161–195.

Sage, R. F. and Kubien, D. S. (2007) The temperature response of C3 and C4 photosynthesis. Plant, Cell and Environment 30: 1086–1106.

Sage, R. F. and Sharkey, T. D. (1987) The effect of temperature on the occurrence of o2 and co2 insensitive photosynthesis in field grown plants. Plant Physiol. 84: 658–664.

Table A2. Running speeds in lizards as a function of ambient temperature (dataset *Running_raw_data*.txt).
Acclimation temperatures are provided within parenthesis with the species ID when multiple curves were reported.

Species	Ambient Temperature (ºC) Performance (m s^{-1})	Reference
Ctenotus regius	ta = 8.7, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0, 0.18, 0.44, 0.5, 0.89, 0.99, 0.68, 0	Huey & Bennett 1987
Ctenotus taeniolatus	ta = 9.7, 11.4, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3, 44.7 pf = 0, 0, 0.29, 0.59, 0.79, 0.96, 1.05, 1.04, 1.18, 0	Huey & Bennett 1987
Ctenotus uber	ta = 9.1, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3, 45.5 pf = 0, 0, 0.36, 0.72, 1.09, 1.41, 1.64, 1.58, 1.65, 0	Huey & Bennett 1987
Eremiascinus fasciolatus	ta = 9, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0.04, 0.24, 0.38, 0.5, 0.67, 0.83, 0.56, 0	Huey & Bennett 1987
Hemiergis peronii	ta = 9.6, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0.11, 0.27, 0.39, 0.37, 0.49, 0.37, 0, 0	Huey & Bennett 1987
Sphenomorphus kosciuskoi	ta = 2.5, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0.17, 0.34, 0.53, 0.7, 0.86, 1.04, 0.34, 0	Huey & Bennett 1987
Sphenomorphus quoyi	ta = 6, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0, 0.69, 0.96, 1.27, 1.52, 1.21, 0, 0	Huey & Bennett 1987
Sphenomorphus tympanus	ta = 2.9, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0.24, 0.67, 0.93, 1.17, 1.42, 1.49, 0.94, 0	Huey & Bennett 1987
Leiolopisma entrecasteauxii	ta = 2.5, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0.23, 0.37, 0.65, 0.88, 1.11, 1.18, 0.94, 0	Huey & Bennett 1987
Leiolopisma entrecasteauxii	ta = 2.5, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 39.3 pf = 0, 0.13, 0.25, 0.41, 0.59, 0.73, 0.89, 0.67, 0	Huey & Bennett 1987
Egernia whitii	ta = 4, 9.7, 15.3, 20.4, 25.5, 30.5, 34.9, 37.3, 42.8 pf = 0, 0.15, 0.31, 0.47, 0.67, 0.91, 0.93, 1.09, 0	Huey & Bennett 1987
Sceloropus undulatus	ta = 11.4, 20, 25, 27.5, 30, 33, 36, 38, 40.4 pf = 0, 0.65, 1.33, 1.35, 1.6, 1.62, 1.73, 1.52, 0	Angiletta EA 2002

Psammodromus hispanicus	ta = 25, 30, 32.5, 35, 37.5, 40, 45.5	Bauwens EA 1995
	pf = 0.79, 0.89, 1.12, 1.36, 1.34, 1.09, 0	
Podarcis bocagei	ta = 25, 30, 32.5, 35, 37.5, 40, 45.4	Bauwens EA 1995
	pf = 0.84, 1.09, 1.2, 1.33, 1.19, 1.06, 0	
Podarcis h. hispanica	ta = 25, 30, 32.5, 35, 37.5, 40, 44.5	Bauwens EA 1995
	pf = 0.99, 1.42, 1.63, 1.65, 1.69, 1.41, 0	
Podarcis h. atrata	ta = 25, 30, 32.5, 35, 37.5, 40, 44.6	Bauwens EA 1995
	pf = 0.65, 0.82, 1.07, 1.19, 1.2, 1.11, 0	
Podarcis lilfordi	ta = 25, 30, 32.5, 35, 37.5, 40, 43.3	Bauwens EA 1995
	pf = 1.35, 1.77, 1.95, 2.04, 2.13, 1.95, 0	
Lacerta agilis	ta = 25, 30, 32.5, 35, 37.5, 40, 43.9	Bauwens EA 1995
	pf = 0.92, 1.21, 1.32, 1.54, 1.59, 1.37, 0	
Lacerta schreiberi	ta = 25, 30, 32.5, 35, 37.5, 40, 43	Bauwens EA 1995
	pf = 1.11, 1.45, 1.52, 1.69, 1.68, 1.49, 0	
Lacerta vivipara	ta = 2.9, 20, 25, 27.5, 30, 32.5, 35, 40.5	VanDamme EA 1991, McConnachie EA 2007
	pf = 0, 0.4, 0.53, 0.61, 0.73, 0.82, 0.83, 0	
Podarcis tiliguerta	ta = 20, 25, 27.5, 30, 32.5, 35, 37.5, 43	VanDamme EA 1989
	pf = 1.07, 1.66, 1.82, 1.78, 1.9, 2.21, 2.34, 0	
Hemidactylus frenatus	ta = 11.9, 15, 20, 25, 30, 34, 37.5, 40, 42.4	Huey EA 1989
	pf = 0, 0.65, 1.21, 1.67, 2.05, 2.09, 1.99, 1.88, 0	
Takydromus hsuehshanensis (cold)	ta = 12, 15, 20, 25, 30, 32.5, 35, 37.5, 40, 43.1	Huang & Tu 2008, 2009
	pf = 0.29, 0.42, 0.72, 1.13, 1.5, 1.79, 1.91, 1.83, 1.51, 0	
Takydromus hsuehshanensis (warm)	ta = 12, 15, 20, 25, 30, 32.5, 35, 37.5, 40, 44.1	Huang & Tu 2008, 2009
	pf = 0.29, 0.42, 0.72, 1.18, 1.64, 2.07, 2.12, 1.96, 1.51, 0	
Takydromus formosanus (warm)	ta = 12, 15, 20, 25, 30, 32.5, 35, 37.5, 40, 43.4	Huang & Tu 2008, 2009
	pf = 0.23, 0.39, 0.92, 1.39, 1.98, 2.33, 2.51, 2.4, 1.65, 0	
Eumeces elegans	ta = 9.4, 12.1, 14.2, 15.9, 17.5, 19.1, 21.7, 23.9, 25.3, 27.1, 30.2, 31.4, 32.6, 34.1, 35.1, 36.5, 38	Du EA 2007
	pf = 0, 0.15, 0.2, 0.21, 0.32, 0.34, 0.39, 0.41, 0.44, 0.46, 0.47, 0.5, 0.55, 0.48, 0.48, 0.43, 0.21	
Xantusia vigilis (20ºC)	ta = 4.5, 12.5, 15, 20, 25, 30, 34, 37.5, 40.5	Kaufmann & Bennett 1989
	pf = 0, 0.27, 0.41, 0.69, 0.94, 1.05, 1.14, 0.19, 0	
Xantusia vigilis (30ºC)	ta = 9.4, 12.5, 15, 20, 25, 30, 34, 37.5, 43	Kaufmann & Bennett 1989
	pf = 0, 0.2, 0.37, 0.68, 0.94, 1.12, 1.16, 1.04, 0	

Platysaurus intermedius	ta = 8.8, 15, 20, 25, 30, 35, 40, 44.7	Lailvaux EA 2003
	pf = 0, 0.72, 1.26, 1.61, 1.73, 1.85, 1.33, 0	
Xantusia riversiana	ta = 6.6, 10, 15, 20, 25, 28, 30, 35, 39	Mautz EA 1992
	pf = 0, 0.32, 0.72, 1.09, 1.53, 1.45, 1.51, 1.44, 0	
Varanus griseus	ta = 18, 21, 25, 30, 35, 37, 41	Okafor 2010
	pf = 0.9, 1.3, 1.6, 2.5, 3, 3, 2.81	
Podarcis atrata	ta = 26, 31, 33, 35, 37, 39, 45	Castilla & Bauwens 1991
	pf = 0.74, 0.92, 1.12, 1.29, 1.23, 1.14, 0	
Agama savignyi	ta = 12, 18, 22, 26, 30, 34, 38, 42, 47.2	Hertz EA 1982, Hertz EA 1983
	pf = 0, 1.03, 1.44, 1.86, 2.44, 3, 2.91, 2.75, 0	
Plestiodon gilberti	ta = 7.7, 20, 24, 28, 30, 32, 34, 36, 38, 42.3	Youssef EA 2008
	pf = 0, 0.51, 0.76, 0.86, 0.87, 0.97, 1.05, 1.13, 1.02, 0	
Takydromus septentrionalis	ta = 4.9, 17, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42.3	Xiang EA 1996
	pf = 0, 0.31, 0.36, 0.6, 0.65, 0.68, 0.77, 0.77, 0.82, 0.74, 0.65, 0.56, 0.49, 0	
Takydromus sexlineatus	ta = 6.4, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 42.2	Zhang & Ji 2004
	pf = 0, 0.46, 0.46, 0.59, 0.6, 0.64, 0.91, 1, 1.03, 0.91, 0.45, 0	
Gallotia stehlini	ta = 12.4, 24, 28, 32, 36, 40, 43.6	Cejudo & Marquez 2001
	pf = 0, 2.15, 2.49, 2.72, 2.91, 2.86, 0	
Gambelia wislizenii	ta = 11.6, 17, 20, 26, 30, 35, 38, 40	Crowley & Pietruska1983
	pf = 0, 0.6, 1.11, 2.69, 2.96, 3.3, 2.65, 3.34	
Eremias brenchleyi	ta = 3.3, 19, 23, 26, 28, 31, 34, 36, 38, 40, 41, 43.6	Xu & Ji 2006
	pf = 0, 0.86, 1.18, 1.27, 1.32, 1.48, 1.45, 1.3, 1.03, 1.01, 0.97, 0	
Eremias argus	ta = 1, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 44.9	Lai-Gao EA 2006
	pf = 0, 0.68, 0.82, 0.93, 1.05, 1.1, 1.15, 1.19, 1.24, 1.36, 1.41, 1.28, 0	
Sceloporus occidentalis	ta = 9.6, 15.1, 20.6, 25.6, 29.7, 34.7, 35.2, 39.4, 25.1	Marsh & Bennett 1986
	pf = 0.29, 1.05, 1.99, 2.64, 3.04, 3.07, 3.24, 3.18, 2.4	
Dipsosaurus dorsalis	ta = 14.2, 15.7, 21, 25.5, 30.6, 34.6, 40.1, 44.2	Marsh & Bennett 1985, Simandle EA 2001
	pf = 0, 0.15, 1.55, 2.87, 3.24, 3.72, 4.27, 3.84	
Anolis intermedius	ta = 11.1, 20.2, 26.3, 30.8, 38.4	Van Berkum 1986
	pf = 0, 0.62, 0.94, 0.91, 0	
Anolis humilis	ta = 12.4, 22.3, 26.4, 30.5, 35.6	Van Berkum 1986
	pf = 0, 0.87, 1.08, 1.05, 0	

Liolaemus baguali	ta = 5.2, 29.1, 33.1, 35.6, 37.6, 39.3, 43.5	Bonino EA 2011
	pf = 0, 1.82, 2.16, 2.27, 2.16, 1.82, 0	
Liolaemus gallardoi	ta = 8.5, 27, 30.4, 33.2, 35.6, 37.9, 44.1	Bonino EA 2011
	pf = 0, 1.46, 1.73, 1.82, 1.73, 1.46, 0	
Liolaemus hatcheri	ta = 7, 28.3, 31.8, 34.3, 36.4, 38.2, 43.1	Bonino EA 2011
	pf = 0, 1.34, 1.6, 1.68, 1.6, 1.34, 0	
Liolaemus kingii	ta = 7.4, 27.1, 31, 34, 36.5, 38.7, 44.2	Bonino EA 2011
	pf = 0, 1.94, 2.31, 2.43, 2.31, 1.94, 0	
Liolaemus kolengh	ta = 5.5, 26.1, 30.4, 33.7, 36.2, 38.5, 44	Bonino EA 2011
	pf = 0, 1.06, 1.25, 1.32, 1.25, 1.06, 0	
Liolaemus magellanicus	ta = 8.3, 24.2, 28, 31.2, 34, 36.7, 43.6	Bonino EA 2011
	pf = 0, 0.89, 1.05, 1.11, 1.05, 0.89, 0	
Liolaemus zullyi	ta = 8.4, 27.1, 30.9, 33.8, 36.4, 38.5, 43.9	Bonino EA 2011
	pf = 0, 1.34, 1.6, 1.68, 1.6, 1.34, 0	

References:

Angilletta, M. J., Hill, T. and Robson, M. A. (2002) Is physiological performance optimized by thermoregulatory behavior? J Therm Biol. 27: 199–204.

Bauwens, D. et al. (1995) Evolution of sprint speed in lacertid lizards: morphological, physiological and behavioral covariation. Evolution 49: 848–863.

Bonino, M. F. et al. (2011) Running in cold weather: Morphology, thermal biology, and performance in the southernmost lizard clade in the world (*Liolaemus lineomaculatus* section: Liolaemini: Iguania). J Exp Zool 315A: 495–503.

Castilla, A. M. and Bauwens, D. (1991) Thermal biology, microhabitat selection, and conservation of the insular lizard *Podarcis hispanica atrata*. Oecologia 85: 366–374.

Cejudo, D. and Márquez, R. (2001) Sprint performance in the lizards *Gallotia simonyi* and *Gallotia stehlini* (Lacertidae): implications for species management. Herpetologica 57: 87–98.

Crowley, S. R. and Pietruszka, R. D. (1983) Aggressiveness and vocalization in the leopard lizard (*Gambelia wislizennii*): the influence of temperature. Anim Behav 31: 1055–1060.

Du, W. G. et al. (2007) Thermal dependence of food assimilation and locomotor performance in juvenile blue-tailed skinks, *Eumeces elegans*. Anim Biol 57: 29–38.

Hertz, P. E., Huey, R. B. and Nevo, E. (1982) Fight versus flight: body temperature influences defensive responses of lizards. Anim Behav 30: 676-679.

Hertz, P. E., Huey, R. B. and Nevo, E. (1983) Homage to Santa Anita: thermal sensitivity of sprint speed in agamid lizards. Evolution 37: 1075–1084.

Huang, S. P. and Tu, M. C. (2008) Heat tolerance and altitudinal distribution of a mountainous lizard, *Takydromus hsuehshanensis*, in Taiwan. J Therm Biol 33: 48–56.

Huey, R. B. et al. (1989) Thermal biology of nocturnal ectotherms: is sprint performance of geckos maximal at low body temperatures? Physiol Zool 62: 488–504.

Huey, R. B. and Bennett, A. F. (1987) Phylogenetic studies of coadaptation: preferred temperatures versus optimal performance temperatures of lizards. Evolution, 41: 1098–1115.

Kaufmann, J. S. and Bennett, A. F. (1989) The effect of temperature and thermal acclimation on locomotor performance in *Xantusia vigilis*, the desert night lizard, Physiol Zool 62: 1047–1058.

Lailvaux, S. P., Alexander, G. J. and Whiting, M. J. (2003) Sex-based differences and similarities in locomotor performance, thermal preferences, and escape behaviour in the lizard *Platysaurus intermedius wilhelmi*. Physiol Biochem Zool 76: 511–521.

Luo, L., Qu, Y. and Ji, X. (2006) Thermal dependence of food assimilation and sprint speed in a lacertid lizard *Eremias argus* from northern China. Acta Zool Sinica 52: 256–262.

Marsh, R. L. and Bennett, A. F. (1985) Thermal dependence of isotonic contractile properties of skeletal muscle and sprint performance of the lizard *Dipsosaurus dorsalis*. J Comp Physiol B 155: 541–551.

Marsh, R. L. and Bennett, A. F. (1986) Thermal dependence of sprint performance of the lizard *Sceloporus occidentalis*. J Exp Biol 126: 79–87.

Mautz, W., Daniels, C. and Bennett, A. f. (1992) Thermal dependence of locomotion and aggression in a xantusiid lizard. Herpetologica, 48: 271–279.

McConnachie, S., Alexander, G. J. and Whiting, M. J. (2007) Lower temperature tolerance in the temperate, ambush foraging lizard *Pseudocordylus melanotus melanotus*. J Therm Biol 32: 66–71.

Okafor, A. I. (2010) The influence of body temperature on sprint speed and anti-predatory defensive responses of the North African monitor lizard, *Varanus griseus*. African J Biotech 9: 778–781.

Simandle, E. T. et al. (2001) Lizards, lipids, and dietary links to animal function. Physiol Biochem Zool 74: 625–640.

Van Berkum, F. H. (1986) Evolutionary patterns of the thermal sensitivity of sprint speed in anolis lizards. Evolution 40: 594–604.

Van Berkum, F. H. (1988) Latitudinal patterns of the thermal sensitivity of sprint speed in lizards. Am Nat 132: 327–343.

Van Damme, R. et al. (1989) Altitudinal variation of the thermal biology and running performance in the lizard *Podarcis tiliguerta*. Oecologia 80: 516–524.

Van Damme, R., Bauwens, D. and Verheyen, R. F. (1991) The thermal dependence of feeding behaviour, food consumption and gut-passage time in the lizard *Lacerta vivipara*. Funct Ecol 5: 507–517.

Xiang, J., Weiguo, D. and Pingyue, S. (1996) Body temperature, thermal tolerance and influence of temperature on sprint speed and food assimilation in adult grass lizards, Takydromus septentrionalis. J Therm Biol 21: 155–162.

Xu, X. F. and Ji, X. (2006) Ontogenetic shifts in thermal tolerance, selected body temperature and thermal dependence of food assimilation and locomotor performance in a lacertid lizard, *Eremias brenchleyi*. Comp Biochem Physiol 143A: 118–124.

Youssef, M. K., Adolph, S. C. and Richmond, J. Q. (2008) Evolutionarily conserved thermal biology across continents: the North American lizard *Plestiodon gilberti* (Scincidae) compared to Asian *Plestiodon*. J Therm Biol 33: 308–312.

Zhang, Y. P. and Ji, X. (2004) The thermal dependence of food assimilation and locomotor performance in southern grass lizards, *Takydromus sexlineatus* (Lacertidae). J Therm Biol 29: 45–53.

Table A3. Intrinsic rates of population increase in insects as a function of ambient temperature (dataset *Fitness_raw_data*.txt). Acclimation temperatures are provided within parenthesis with the species ID when multiple curves were reported.

Species	Ambient Temperature (ºC)	Performance (day^{-1})	Reference
Acarus farris	ta = 7, 10, 15, 20, 25, 29		Sanchez-Ramos & Castañera 2007
	pf = 0.01, 0.05, 0.13, 0.2, 0.25, 0.1		
Aphelinus semiflavus	ta = 10, 15.6, 18.3, 21.1, 23.9, 26.7		Force & Messenger 1964
	pf = 0, 0.09, 0.24, 0.34, 0.2, 0		
Aphis gossypii	ta = 10, 15, 20, 25, 30, 35		Parajulee 2007
	pf = 0.06, 0.15, 0.28, 0.37, 0.31, 0.32		
Aphis gossypii	ta = 15, 17.5, 20, 22.5, 25, 27.5, 30, 32.5		Satar EA 2005
	pf = 0.21, 0.29, 0.36, 0.42, 0.53, 0.44, 0.43, 0.13		
Aphis gossypii	ta = 10, 15, 20, 25, 30		Zamani EA 2006
	pf = 0.06, 0.18, 0.32, 0.42, 0.36		
Busseola fusca	ta = 18, 21, 24, 27, 30, 32		Bruce EA 2009
	pf = 0.09, 0.15, 0.19, 0.28, 0.25, 0.17		
Busseola fusca	ta = 18, 21, 24, 27, 30, 32		Bruce EA 2009
	pf = 0.09, 0.15, 0.2, 0.28, 0.29, 0.27		
Cactoblastis castorum	ta = 18, 22, 26, 30, 34		Legaspi EA 2007
	pf = 0.01, 0.03, 0.05, 0.06, 0.03		
Calandra oryzae	ta = 13, 15.2, 18.2, 23, 25.5, 29.1, 32.3, 33.5, 35		Birch 1953
	pf = 0, 0, 0.02, 0.06, 0.09, 0.11, 0.07, 0.02, 0		
Cotesia plutellae	ta = 15, 20, 25, 30, 32.5, 35		Liu EA 2000
	pf = 0.07, 0.16, 0.27, 0.29, 0.25, 0		
Cryptolestes ferrugineus	ta = 20, 22.5, 25, 27.5, 30, 32.5, 35, 37.5, 40		Smith 1965
	pf = 0, 0.03, 0.06, 0.08, 0.1, 0.12, 0.14, 0.09, 0.07		
Dactylopius austrinus	ta = 20, 22.5, 25, 27.5, 30, 32, 34		Hosking 1984

	pf = 0.04, 0.07, 0.1, 0.13, 0.15, 0.14, 0.09	
Diaphorina citri	ta = 15, 20, 25, 28, 30	Liu & Tsai 2000
	pf = 0.04, 0.09, 0.16, 0.2, 0.13	
Ebcarsia bimaculata	ta = 20, 23, 26, 29, 32	Qiu EA 2007
	pf = 0.08, 0.13, 0.19, 0.22, 0.21	
Eretmocerus furuhashii	ta = 23, 29, 20, 26, 32	Qiu EA 2007
	pf = 0.1, 0.17, 0.03, 0.15, 0.16	
Gonatocerus triguttatus	ta = 15, 20, 25, 30, 33	Pilkington & Hodle 2007
	pf = 0.04, 0.13, 0.28, 0.27, 0.21	
Hyperaspis notata	ta = 18, 20, 25, 30, 32, 34	Dreyer EA 1997
	pf = 0.02, 0.06, 0.08, 0.1, 0.06, 0	
Hyperaspis notata	ta = 18, 20, 25, 30, 32, 34	Dreyer EA 1997
	pf = 0.02, 0.06, 0.07, 0.12, 0.08, 0	
Hypothenemus hampei	ta = 20, 23, 25, 27, 30	Jaramillo EA 2009
	pf = 0.06, 0.1, 0.14, 0.12, 0.1	
Liposcelis badia	ta = 20, 22.5, 25, 27.5, 30, 32.5, 35	Jiang EA 2008
	pf = 0.02, 0.02, 0.03, 0.05, 0.04, 0.02, 0	
Liposcelis decolor	ta = 20, 22.5, 25, 27.5, 30, 32.5, 35, 37.5	Tang EA 2008
	pf = 0.02, 0.03, 0.04, 0.04, 0.05, 0.06, 0.05, 0.01	
Liposcelis entomophila	ta = 20, 22.5, 25, 27.5, 30, 32.5, 35	Dong EA 2007
	pf = 0.02, 0.03, 0.04, 0.07, 0.06, 0.05, 0.04	
Liposcelis paeta	ta = 22.5, 25, 27.5, 30, 32.5, 35, 37.5	Wang EA 2009
	pf = 0.02, 0.03, 0.04, 0.04, 0.05, 0.05, 0.05	
Liposcelis tricolor	ta = 20, 22.5, 25, 27.5, 30, 32.5, 35	Dong EA 2007
	pf = 0.01, 0.01, 0.02, 0.03, 0.04, 0.03, 0.01	
Liriomyza sativae	ta = 15, 20, 25, 30, 35	Haghani EA 2006
	pf = 0.02, 0.11, 0.2, 0.19, 0	
Macrolophus pygmaeus	ta = 15, 20, 25, 27.5, 30	Perdikis & Lykouressis 2002
	pf = 0.04, 0.07, 0.1, 0.1, 0.08	
Macrolophus pygmaeus	ta = 15, 20, 25, 27.5, 30	Perdikis & Lykouressis 2002
	pf = 0.04, 0.06, 0.1, 0.1, 0.07	
Macrosiphum euphorbiae	ta = 5, 10, 15, 20, 25, 30	Barlow 1962

	pf = 0.05, 0.11, 0.17, 0.22, 0.16, 0	
Myzus persicae	ta = 5, 10, 15, 20, 25, 30	Barlow 1962
	pf = 0.07, 0.12, 0.34, 0.45, 0.45, 0	
Myzus persicae	ta = 5, 10, 15, 20, 25, 30, 32	Davis EA 2006
	pf = 0, 0.08, 0.12, 0.26, 0.22, 0.22, 0	
Paronychiurus kimi	ta = 17, 20, 22, 25, 28	Choi EA 2002
	pf = 0.04, 0.07, 0.07, 0.09, 0.05	
Phyllonorycter corylifoliella	ta = 15, 20, 25, 30, 33	Amiri EA 2010
	pf = 0.03, 0.07, 0.1, 0.1, 0.05	
Rhizopertha dominica	ta = 18.3, 29, 32.3, 34, 38.2, 38.6	Birch 1953
	pf = 0, 0.08, 0.1, 0.11, 0.04, 0	
Sesamia calamistis	ta = 18, 21, 24, 27, 30, 32	Bruce EA 2009
	pf = 0.08, 0.15, 0.16, 0.28, 0.2, 0.17	
Sesamia calamistis	ta = 18, 21, 24, 27, 30, 32	Bruce EA 2009
	pf = 0.1, 0.14, 0.2, 0.28, 0.3, 0.29	
Sesamia nonagrioides	ta = 18, 21, 24, 27, 30, 32	Bruce EA 2009
	pf = 0.08, 0.16, 0.17, 0.25, 0.21, 0.15	
Sesamia nonagrioides	ta = 18, 21, 24, 27, 30, 32	Bruce EA 2009
	pf = 0.1, 0.18, 0.22, 0.28, 0.27, 0.26	
Sitobion miscanthi	ta = 12, 15, 20, 25, 28	Turak EA 1998
	pf = 0.08, 0.13, 0.25, 0.28, 0.09	
Stethorus punctillum	ta = 14, 16, 20, 24, 28, 30, 32, 34	Roy EA 2003
	pf = 0, 0.01, 0.05, 0.1, 0.11, 0.17, 0.12, 0	
Thrips tabaci	ta = 15, 20, 23, 25, 30	Murai2000
	pf = 0.06, 0.11, 0.15, 0.17, 0.02	
Toxoptera citricidus	ta = 11.3, 15.2, 19.9, 21.5, 25.1, 27.1, 29.9	Komazaki 1982
	pf = 0.07, 0.14, 0.19, 0.32, 0.32, 0.42, 0.16	
Trichogramma bruni	ta = 15, 20, 25, 30, 35	Kalyebi EA 2006
	pf = 0.08, 0.14, 0.21, 0.26, 0	
Trichogramma mwanzai	ta = 15, 20, 25, 30, 35	Kalyebi EA 2006
	pf = 0.11, 0.19, 0.34, 0.32, 0.1	
Trichogramma pretoisum	ta = 18, 20, 22, 25, 30, 32	Pratissoli & Parra 2000

	pf = 0.11, 0.15, 0.2, 0.31, 0.35, 0.31	
Trichogrammatoidea lutea	ta = 15, 20, 25, 30, 35	Kalyebi EA 2006
	pf = 0.05, 0.16, 0.26, 0.44, 0.22	
Trioxys utilis	ta = 10, 15.6, 18.3, 21.1, 23.9, 26.7	Force & Messenger 1964
	pf = 0, 0.18, 0.28, 0.48, 0.43, 0	
Tetraneura nigriabdominalis	ta = 10, 15, 20, 25, 30	Kuo EA 2006
	pf = 0, 0.05, 0.12, 0.21, 0.24	

References:

Amiri, A. et al. (2010) Effect of temperature on demographic parameters of the Hawthorn Red Midget Moth, *Phyllonorycter corylifoliella*, on Apple. J Insect Sc 10:1–12.

Barlow, C. A. (1962) The influence of temperature on the growth of experimental populations of *Myzus persicae* (Sulzer) and *Macrosiphum euphorbiae* (Thomas). Can J Zool 40: 145–156.

Birch, L. C. (1953) Experimental background to the study of the distribution and abundance of insects: I. The influence of temperature, moisture and food on the innate capacity for increase of three grain beetles. Ecology 34: 698–711.

Bruce, A. Y., Schulthess, F. and Mueke, J. (2009) Host acceptance, suitability, and effects of host deprivation on the West African egg parasitoid *Telenomus isis* (Hymenoptera: Scelionidae) reared on East African stemborers under varying temperature and relative humidity regimens. Environmen Entomol 38: 904–919.

Choi, W., Ryoo, M. and Kim, J. G. (2002) Biology of *Paronychiurus kimi* (Collembola: Onychiuridae) under the influence of temperature, humidity and nutrition. Pedobiologia 46: 548–557.

Davis, J. A., Radcliffe, E. B. and Ragsdale, D. W. (2006) Effects of high and fluctuating temperatures on *Myzus persicae* (Hemiptera: Aphididae). Environmen Entomol 35: 1461–1468.

Dong, P. et al. (2007) Development and reproduction of the psocid *Liposcelis tricolor* (Psocoptera: Liposcelididae) as a function of temperature. Ann Entomol Soc Am 100: 228–235.

Force, D. C. and Messenger, P. S. (1964) Fecundity, reproductive rates, and innate capacity for increase of three parasites of *Therioaphis Maculata* (Buckton). Ecology 45: 706–715.

Haghani, M. et al. (2006) Comparative demography of *Liriomyza sativae* Blanchard (Diptera: Agromyzidae) on cucumber at seven constant temperatures. Insect Sci 13: 477–483.

Hosking, J. R. (1984) The effect of temperature on the population growth potential of *Dactylopzus austrinus* De Lotto (Homoptera: Dactylopiidae),on *Opuntza acirantzaca* Lindley. J Aust Entomol Soc 23:133-139.

Jaramillo, J. et al. (2009) Thermal tolerance of the coffee berry borer *Hypothenemus hampei*: Predictions of climate change impact on a tropical insect pest. PLoS ONE 4: 1–11.

Jiang, H.-B. et al. (2008) Temperature-dependent development and reproduction of a novel stored product psocid, *Liposcelis badia* (Psocoptera: Liposcelididae), Environmen Entomol 37: 1105–1112.

Kalyebi, A. et al. (2006) The effect of temperature and humidity on the bionomics of six African egg parasitoids (Hymenoptera: Trichogrammatidae). Bull Entomol Res 96: 305–314.

Komazaki, S. (1982) Effects of constant temperatures on population growth of three aphid species, *Toxoptera citricidus* (Kirkaldy), *Aphis citricola* (Van Der Goot) and *Aphis gossypii* (Glover) (Homoptera : Aphididae) on Citrus. Appl Entomol Zool 17: 75–81.

Kuo, M.-H. et al. (2006) Temperature-dependent development and population growth of *Tetraneura nigriabdominalis* (Homoptera: Pemphigidae) on three host plants, J Economic Entomol 99: 1209–1213.

Legaspi, J. C. and Legaspi Jr., B. C. (2007) Life table analysis for *Cactoblastis cactorum* immatures and female adults under five constant temperatures: implications for pest management. Environmen Entomol 100: 497–505.

Liu, S. et al. (2000) Biology of *Oomyzus sokolowskii* and effect of temperature on its population parameters. Acta Entomol Sinica 43: 159–167.

Liu, Y. H. and Tsai, J. H. (2000) Effects of temperature on biology and life table parameters of the Asian citrus psyllid, *Diaphorina citri* Kuwayama (Homoptera: Psyllidae). Ann Appl Biol 137: 201–206.

Murai, T. (2000) Effect of temperature on development and reproduction of the onion thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae), on pollen and honey solution. Appl Entomol Zool 35: 499–504.

Parajulee, M. N. (2007) Influence of constant temperatures on life history parameters of the cotton aphid, *Aphis gossypii*, infesting cotton. Environmen Entomol 36: 666–672.

Perdikis, D. C. and Lykouressis, D. P. (2002) Life table and biological characteristics of *Macrolophus pygmaeus* when feeding on *Myzus persicae* and *Trialeurodes vaporariorum*. Entomologia Experimentalis et Applicata 102: 261–272.

Pilkington, L. J. and Hoddle, M. S. (2007) Use of life tables to quantify reproductive and developmental biology of *Gonatocerus triguttatus* (Hymenoptera: Mymaridae), an egg parasitoid of *Homalodisca vitripennis* (Hemiptera: Cicadellidae). Biol Control 42: 1–8.

Pratissoli, D. and Parra, J. R. P. (2000) Fertility life table of *Trichogramma pretiosum* (Hym., Trichogrammatidae) in eggs of *Tuta absoluta* and *Phthorimaea operculella* (Lep., Gelechiidae) at different temperatures. J Appl Entomol 124: 339–342.

Qiu, B. L. et al. (2007) Suitability of *Bemisia tabaci* (Hemiptera: Aleyrodidae) instars for the parasitization by *Encarsia bimaculata* and *Eretmocerus sp. nr. furuhashii* (Hymenoptera: Aphelinidae) on glabrous and hirsute host plants. Biocontrol Sci Tech 17: 823–839.

Roy, M., Brodeur, J. and Cloutier, C. (2003) Effect of temperature on intrinsic rates of natural increase of a coccinellid and its spider mite prey. BioControl, 48: 57–72.

Sánchez-Ramos, I. and Castañera, P. (2007) Effect of temperature on reproductive parameters and the longevity of *Acarus farris* (Acari: Acaridae). J Stored Prod Res 43: 578–586.

Satar, S., Kersting, U. and Uygun, N. (2005) Effect of temperature on development and fecundity of *Aphis gossypii* Glover (Homoptera: Aphididae) on cucumber. J Pest Sci 78: 133–137.

Smith, L. B. (1965) The intrinsic rate of natural increase of *Cryptolestes ferrugineus* (Stephens), J Stored Prod Res 1: 35–49.

Stäubli Dreyer, B. et al. (1997) The influence of temperature on the life table of *Hyperaspis notata*, Entomologia Experimentalis et Applicata 84: 85–92.

Tang, P.-A. et al. (2008) Development, survival, and reproduction of the psocid *Liposcelis decolor* (Psocoptera: Liposcelididae) at constant temperatures. Ann Entomol Soc Am 101: 1017–1025.

Turak, E. et al. (1998) Different responses to temperature in three closely-related sympatric cereal aphids. Entomologia Experimentalis et Applicata 86: 49–58.

Wang, J.-J. et al. (2009) Development, survival, and reproduction of the Psocid *Liposcelis paeta* (Psocoptera: Liposcelididae) as a function of temperature. J Econom Entomol 102: 1705–1713.

Zamani, A. A. et al. (2006) Effect of temperature on biology and population growth parameters of *Aphis gossypii* Glover (Hom., Aphididae) on greenhouse cucumber. J Appl Entomol 130: 453–460.

Appendix B

Script for R that include the functions to fit the thermal performance model developed in our study (eqn 3 in main text) employing non-linear regression and a function to plot the curves based on parameters Q_{10}, C, d and T_{th}.

```
# File - Thermal_function.R

# Functions to perform analyses and plot thermal performance curves

# fit.thermal.curve - fits non-linear thermal curve to empirical data (ta vs performance)
# plot.thermal.curve - plot thermal curves with different parameters (q10,cte,thr and decay)


# ---------------------------Function 'fit.thermal.curve'--------------------------------------- #

# Nonlinear fitting to analyze empirical thermal performance curves.

'fit.thermal.curve' <-
function(ta,pf,xlab="ta",ylab="pf",plot=TRUE){
             xx <- matrix(,1,13)
             raw.pf <- pf
             pf <- pf/max(pf)
             test <- data.frame(ta=ta,pf=pf)
             q10 <- seq(1.5,3.5,by=0.1)
             CTE <- seq(0.00,0.1,by=0.02)
             thr <- seq(10,35,by=2)
             decay <- seq(0.000,0.01,by=0.002)
 out <- c(NA,NA,NA,NA,NA)
             for (i in 1:length(q10)){
             for (j in 1:length(CTE)){
             for (l in 1:length(thr)){
             for (k in 1:length(decay)){
                    pf.therm <- CTE[j]*10^(log10(q10[i])/(10/ta))
                    pf.state <- ifelse(ta<thr[l],1,1-decay[k]*(thr[l]-ta)^2)
                    pf.tot <- pf.therm*pf.state
                    out <- rbind(out,c(q10[i],CTE[j],thr[l],decay[k],sum((pf.tot-pf)^2)))
             }}}}
 out <- out[order(out[,5]),]
 out.min <- out[which(out[,5] == min(na.omit(out[,5]))),]
 opt <- function(ta,q10,CTE,thr,decay)
       {ifelse(ta<thr,(CTE*10^(log10(q10)/(10/ta))),(CTE*10^(log10(q10)/(10/ta)))*(1-decay*(thr-
 ta)^2))}
 m.opt <- nls(pf ~ opt(ta, q10, CTE, thr,decay), data = test, start = list(q10 = out.min[1],CTE =
 out.min[2], thr = out.min[3], decay = out.min[4]), trace = T,control = list(maxiter=5000,warnOnly
 = TRUE,minFactor = 0))
 r.square <- summary(lm(pf ~ predict(m.opt)))$r.squared
 q10 <- summary(m.opt)$coefficients[1]
 CTE <- summary(m.opt)$coefficients[2]
 thr <- summary(m.opt)$coefficients[3]
 decay <- summary(m.opt)$coefficients[4]
 ta1 <- seq(0,50,by=0.1)
 pf.therm <- CTE*10^(log10(q10)/(10/ta1))
 pf.state <- ifelse(ta1<thr,1,1-decay*(thr-ta1)^2)
 pf.tot <- pf.therm*pf.state
 ta.opt <- ta1[which(pf.tot==max(pf.tot))]
 pf.tot <- ifelse(pf.tot<0,NA,pf.tot)
 k <- -10*(1-decay*(10/log(q10)+sqrt(1/decay + (10/log(q10))^2)))
 breadth.50 <- as.numeric(breadth.thermal.curve(q10,CTE,thr,decay,breadth=0.5)[3])
```

```
breadth.80 <- as.numeric(breadth.thermal.curve(q10,CTE,thr,decay,breadth=0.8)[3])
max.y <- max(raw.pf)*max(na.omit(pf.tot))

if(plot==TRUE){
plot(ta,raw.pf,type="b",xlab=xlab,ylab=ylab,xaxs="i",yaxs="i",bty="l",xlim=c(0,50),ylim=c(-
0.02,max.y*1.25),las=1,bg="red",cex=1.3,pch=21)
points(ta1,max.y*pf.tot/max(na.omit(pf.tot)),type="l",col="red")}

if(m.opt$convInfo$stopMessage == 'converged'){
xx[1,1] <- q10
xx[1,2] <- summary(m.opt)$coefficients[2]*max(raw.pf)
xx[1,3] <- thr
xx[1,4] <- decay
xx[1,5] <- thr + (1/decay)^0.5
xx[1,6] <- max(na.omit(pf.tot))*max(raw.pf)
xx[1,7] <- ta.opt
xx[1,8] <- breadth.50
xx[1,9] <- breadth.80
xx[1,10] <- r.square
xx[1,11] <- length(test$pf)
xx[1,12] <- attr(logLik(m.opt),"df")
xx[1,13] <- AIC(m.opt)}

colnames(xx) <-
c("q10","cte","thr","decay","ctmax","max.pf","ta.opt","breadt.50","breadth.80","r.square","n.sampl
es","K.param","AIC")
xx <- data.frame(xx)
list(xx,paste(m.opt$convInfo$stopMessage))}
```

```
# -------------------------- Function 'plot.thermal.curve' ------------------------------------ #

# Function to plot different curves (reduced model) manipulating q10, CTE, thr and decay

'plot.thermal.curve' <-
function(q10,CTE,thr,decay,points=FALSE,bound=FALSE,xlab="ta",ylab="pf",col.q10="red",col.th="blue"
,col="black",...){
q10 <- as.numeric(q10)
CTE <- as.numeric(CTE)
thr <- as.numeric(thr)
decay <- as.numeric(decay)
ta <- seq(0,50,by=0.1)
pf.therm <- CTE*10^(log10(q10)/(10/ta))
pf.state <- ifelse(ta<thr,1,1-decay*(thr-ta)^2)
pf.tot <- pf.therm*pf.state
if(bound==TRUE){pf.therm <- pf.therm/max(pf.tot);pf.tot <- ifelse(pf.tot<0,NA,pf.tot/max(pf.tot))}
else{pf.tot <- ifelse(pf.tot<0,NA,pf.tot)}
if(points==FALSE){plot(ta,pf.tot,type="l",las=1,xlab=xlab,ylab=ylab,ylim=c(-
0.02,max(na.omit(pf.tot))),xaxs="i",yaxs="i",bty="l",col=col)}
else{points(ta,pf.tot,type="l",col=col)}
points(ta,pf.state*max(na.omit(pf.tot)),type="l",lty=2,col=col.th)
points(ta,pf.therm,type="l",lty=2,col=col.q10)}
```

```
# ------------------------- Function 'breadth.thermal.curve' ------------------------------------ #

# Function to obtain the breadth of the thermal curve for a given fraction of maximum performance
 (e.g., 80% or 50%, etc)

'breadth.thermal.curve' <- function(q10,CTE,thr,decay,breadth){
 q10 <- as.numeric(q10)
 CTE <- as.numeric(CTE)
 thr <- as.numeric(thr)
 decay <- as.numeric(decay)
 ta.opt <- thr-10/(log(q10))+(sqrt(1/decay + (10/log(q10))^2))
 max.pf <- (CTE*10^(log10(q10)/(10/ta.opt)))*(1-decay*(thr-ta.opt)^2)
 ta <- seq(0,50,by=0.01)
 pf.therm <- (CTE/max.pf)*10^(log10(q10)/(10/ta))
 pf.state <- ifelse(ta<thr,1,1-decay*(thr-ta)^2)
 pf.tot <- pf.therm*pf.state
 ta <- ta[range(which(pf.tot > breadth))]
 ta.breadth <- ta[2] - ta[1]
 data.frame(ta.low = ta[1],ta.high = ta[2], ta.breadth = ta.breadth)}
```

```
# ------------------------------------ EXAMPLES ---------------------------------------------- #

# Example 1
# Function fit.thermal.curve
# Parameters of the thermal curve of running speeds
# from Ctenotus_regius and Eremiascincus_fasciolatus (Huey & Bennett 1987 Evolution 41:1098-1115;
 Table 2)

 # ta <- c(9.7,15.3,20.4,25.5,30.5,34.9,37.3,39.3)          # ambient temperature
 # cr <- c(0.00,0.18,0.44,0.50,0.89,0.99,0.68,0.00)         # running speed C_regius
 # ef <- c(0.04,0.24,0.38,0.50,0.67,0.83,0.56,0)            # running speed E_fasciolatus

 # par(mfrow=c(1,2))
 # fit.thermal.curve(ta,cr,xlab="temperature",ylab="running speed (m/s)",plot=TRUE)
 # fit.thermal.curve(ta,ef,xlab="temperature",ylab="running speed (m/s)",plot=TRUE)


# Example 2
# Function plot.thermal.curve
# Estimating thermal curve parameters for C_regius and plotting
# its components in standard units between 0 and 1 ('bound = TRUE').

 # ta <- c(9.7,15.3,20.4,25.5,30.5,34.9,37.3,39.3)          # ambient temperature
 # cr <- c(0.00,0.18,0.44,0.50,0.89,0.99,0.68,0.00)         # running speed C_regius

 # par(mfrow=c(1,2))
 # fit <- as.data.frame(fit.thermal.curve(ta,cr,xlab="temperature",ylab="running speed (m/s)"))
 # plot.thermal.curve(fit[1],fit[2],fit[3],fit[4],xlab=substitute("temperature"),ylab="relative
 performance")
```

Appendix C

Table C1. Parameters and descriptors of the thermal performance curve obtained with the approach developed here (file *All_parameters_data.txt*)

Species	Code	Type	n	Q_{10}	C	T_{th}	d	CT_{max}	P_{max}	T_{opt}	$T_{breadth}$	R^2
Tidestromia oblongifolia	tophoto	biochem	11	2.01	0.2745	22.1	0.00080	57.5	3.7	46.0	22.2	0.995
Atriplex glabriuscula	aohotphoto	biochem	7	1.62	0.4204	16.5	0.00115	46.0	1.4	31.8	31.7	0.894
Atriplex sabulosa	ascoolphoto	biochem	8	1.60	1.2654	13.7	0.00090	47.0	3.9	31.9	33.9	0.979
Atriplex sabulosa	ashotphoto	biochem	8	2.24	0.2439	-6.0	0.00036	46.7	1.6	35.8	26.4	0.997
Tidestromia oblongifolia	tocoolphoto	biochem	6	1.81	0.1984	20.0	0.00192	42.8	1.0	31.5	25.2	0.946
Tidestromia oblongifolia	tohotphoto	biochem	14	2.07	0.4136	21.4	0.00088	55.2	5.6	44.1	23.4	0.990
Atriplex lentiformis	alhotphoto	biochem	17	2.12	0.2813	18.7	0.00095	51.2	3.3	40.5	25.0	0.990
Nerium oleander	nocoolphoto	biochem	10	1.44	0.8710	12.5	0.00083	47.2	1.9	29.3	39.9	0.963
Larrea divaricata	ldcoolphoto	biochem	8	1.12	1.6789	30.4	0.00291	48.9	2.4	32.3	44.4	0.993
Larrea divaricata	ldhotphoto	biochem	10	1.57	0.5772	20.2	0.00086	54.3	2.3	38.7	34.4	0.988
Nerium oleander (20ºC)	no20cphoto1	biochem	10	1.44	0.8592	12.4	0.00079	48.0	1.9	29.9	40.4	0.958
Nerium oleander (45ºC)	no45cphoto	biochem	18	1.66	0.4656	42.6	0.01340	51.2	4.2	44.4	19.6	0.972
Nerium oleander (45ºC)	no45cphoto1	biochem	10	1.62	0.3888	19.0	0.00084	53.5	1.7	38.5	33.7	0.955
Hordeum vulgare (15ºC)	hv15photo	biochem	5	1.79	1.6934	12.1	0.00137	39.1	5.7	27.0	27.3	0.999
Vicia faba (15ºC)	vf15photo	biochem	5	1.64	1.4411	16.8	0.00190	39.7	4.4	27.1	28.2	1.000
Chenopodium album (25ºC)	ca25photo	biochem	5	1.61	1.1194	16.2	0.00149	42.1	3.4	28.5	30.3	0.982
Lycopersicon esculetum (25ºC)	le25photo	biochem	5	2.52	0.3685	16.1	0.00168	40.5	4.1	32.0	19.8	0.996
Glycine max (25ºC)	gm25photo	biochem	5	2.54	0.3585	18.1	0.00205	40.2	4.3	31.9	19.1	0.998
Abutilon theophrasti (25ºC)	at25photo	biochem	5	2.31	0.5197	16.3	0.00158	41.4	4.6	32.2	21.3	0.992
Embothrium coccineum	ecphoto	biochem	6	2.08	0.2792	14.4	0.00142	41.0	1.6	30.6	23.7	0.973
Cercis canadensis	cccphoto	biochem	6	1.66	0.4503	35.4	0.00706	47.3	2.9	38.7	21.7	0.997
Muhlenbergia glomerata (14ºC)	mg1410photo	biochem	7	2.33	0.2412	12.1	0.00150	37.9	1.6	28.7	21.4	0.979
Muhlenbergia glomerata (26ºC)	mg2622photo	biochem	7	2.65	0.2313	11.2	0.00120	40.1	2.5	31.6	20.1	0.995
Larrea divaricata (20ºC)	ld20photo	biochem	15	1.38	1.9631	24.5	0.00126	52.7	5.3	35.5	39.3	0.921
Larrea divaricata (35ºC)	ld35photo	biochem	14	1.66	1.0007	28.1	0.00156	53.5	5.9	40.5	28.6	0.972
Larrea divaricata (45ºC)	ld45photo	biochem	13	1.66	0.7853	34.8	0.00233	55.5	5.9	43.7	23.9	0.986
Ipomoea batatas	spotphoto	biochem	26	2.10	0.3724	15.7	0.00128	43.7	2.7	33.3	24.0	0.944
Muhlenbergia richardsonis	muhphoto	biochem	10	2.58	0.4751	13.6	0.00134	40.9	5.4	32.3	20.2	0.979
Carex helleri	carphoto	biochem	9	1.73	0.7509	9.4	0.00092	42.4	2.4	28.9	30.8	0.931
Atriplex patula (15ºC)	ap15photo	biochem	14	2.24	0.9099	6.9	0.00168	31.3	3.3	21.9	21.7	0.929

Atriplex rosea (15ºC)	ar15photo	biochem	14	3.17	0.3362	9.9	0.00176	33.8	3.7	26.6	16.9	0.991
Atriplex patula (36ºC)	ap30photo	biochem	17	2.45	0.3621	8.9	0.00149	34.8	2.1	25.9	20.6	0.986
Atriplex rosea (30ºC)	ar30photo	biochem	10	2.77	0.1935	22.6	0.00429	37.9	3.2	31.0	15.5	0.992
Flaveria trinervia	ft1photo	biochem	6	1.69	0.8627	17.0	0.00098	48.9	3.7	35.1	31.1	0.974
Flaveria trinervia	ft2photo	biochem	7	1.85	0.6444	20.0	0.00131	47.6	3.9	35.8	26.7	0.998
Flaveria cronquistii	fcphoto	biochem	9	1.33	1.0006	22.8	0.00189	45.8	2.1	29.7	39.7	0.989
Chenopodium album	chnaphoto	biochem	18	1.67	0.8046	13.2	0.00076	49.4	3.1	34.7	33.3	0.901
Spartina townsendii	sptphoto	biochem	8	2.15	0.4598	12.2	0.00126	40.3	2.7	30.2	23.6	0.971
Agropyron smithii	ags1photo	biochem	14	1.48	1.7029	11.4	0.00051	55.7	4.9	37.1	40.9	0.982
Agropyron smithii	ags2photo	biochem	13	1.41	1.6442	13.6	0.00067	52.1	3.8	32.8	43.2	0.975
Capsicum annuum	caa1photo	biochem	8	1.97	0.7562	11.2	0.00074	48.0	4.8	36.1	27.9	0.973
Lycopersicon esculentum	lyephoto	biochem	7	2.30	0.7108	18.8	0.00248	38.9	6.0	30.2	19.6	0.990
Scrophularis desertorum	scrphoto	biochem	8	1.86	1.3373	9.7	0.00107	40.3	4.9	28.2	27.7	0.950
Ctenotus regius	cr	run	9	3.09	0.0302	28.2	0.00814	39.3	1.0	33.6	12.8	0.972
Ctenotus taeniolatus	ct	run	10	2.79	0.0577	14.5	0.00109	44.7	1.1	36.5	19.5	0.946
Ctenotus uber	cu	run	10	2.74	0.0829	15.9	0.00115	45.5	1.7	37.2	19.7	0.976
Eremiascinus fasciolatus	ef	run	9	2.36	0.0520	31.4	0.01587	39.3	0.9	33.8	13.4	0.961
Hemiergis peronii	hp	run	9	2.31	0.0616	14.3	0.00169	38.7	0.4	29.5	21.2	0.796
Sphenomorphus kosciuskoi	sk	run	9	2.33	0.0820	25.9	0.00573	39.2	1.0	31.9	16.3	0.917
Sphenomorphus quoyi	sq	run	9	2.55	0.1387	15.2	0.00181	38.7	1.4	30.3	19.5	0.828
Sphenomorphus tympanus	st	run	9	3.29	0.0957	3.0	0.00076	39.4	1.6	31.9	18.0	0.970
Leiolopisma entrecasteauxii	lea	run	9	2.08	0.1239	31.2	0.01497	39.4	1.3	33.5	15.0	0.966
Leiolopisma entrecasteauxii	leb	run	9	2.10	0.0790	32.5	0.02120	39.3	0.9	34.1	14.0	0.978
Egernia whitii	ew	run	9	3.16	0.0503	4.6	0.00068	42.8	1.0	35.1	18.6	0.978
Sceloropus undulatus	su	run	9	3.82	0.0467	13.3	0.00135	40.5	1.9	34.0	15.5	0.948
Psammodromus hispanicus	ph	run	7	1.71	0.1994	33.1	0.00656	45.5	1.3	36.8	21.2	0.979
Podarcis bocagei	pb	run	7	1.68	0.2332	29.9	0.00415	45.4	1.3	35.4	23.6	0.995
Podarcis h. hispanica	phh	run	7	2.19	0.1409	26.6	0.00310	44.5	1.7	35.8	19.4	0.998
Podarcis h. atrata	pha	run	7	1.98	0.1133	32.8	0.00713	44.6	1.2	37.0	17.9	0.994
Podarcis lilfordi	pl	run	7	1.40	0.6213	37.5	0.03034	43.3	2.2	38.1	24.6	0.992
Lacerta agilis	la	run	7	1.65	0.2653	35.2	0.01339	43.9	1.6	37.0	19.8	0.999
Lacerta schreiberi	ls	run	7	1.40	0.5097	37.1	0.02836	43.0	1.8	37.7	24.9	0.991
Lacerta vivipara	lv	run	8	3.64	0.0321	3.1	0.00071	40.6	0.8	33.6	16.8	0.990
Podarcis tiliguerta	pt2	run	8	1.46	0.5868	36.3	0.02209	43.0	2.3	37.1	23.0	0.976
Hemidactylus frenatus	hf	run	9	2.92	0.1205	13.5	0.00118	42.6	2.3	34.7	18.7	0.912
Takydromus hsuehshanensis (cold)	thc	run	10	2.28	0.1309	29.4	0.00532	43.1	2.0	35.6	16.9	0.993
Takydromus hsuehshanensis (warm)	thw	run	10	2.46	0.1254	24.0	0.00250	44.0	2.0	35.8	18.7	0.988
Takydromus formosanus (warm)	tfw	run	10	2.82	0.1080	20.4	0.00190	43.3	2.4	35.6	18.0	0.989
Eumeces elegans	ee	run	17	2.65	0.0484	12.1	0.00131	39.8	0.5	31.4	19.9	0.917
Xantusia vigilis (20ºC)	xv20	run	9	2.23	0.1320	17.4	0.00196	40.0	1.0	30.8	21.0	0.844
Xantusia vigilis (30ºC)	xv30	run	9	2.51	0.0945	15.9	0.00137	42.9	1.2	34.2	20.5	0.959
Platysaurus intermedius	pi	run	8	2.13	0.2419	15.1	0.00115	44.6	1.9	34.2	24.1	0.926
Xantusia riversiana	xr	run	9	2.81	0.1371	11.3	0.00130	39.0	1.7	31.0	19.1	0.954
Varanus griseus	vg1	run	7	2.21	0.2330	25.7	0.00229	46.6	3.1	37.5	20.5	0.992
Podarcis atrata	pa	run	7	1.83	0.1514	32.6	0.00655	45.0	1.2	36.7	19.6	0.990

Agama savignyi	as1	run	9	2.51	0.1815	17.3	0.00112	47.2	3.1	38.2	21.2	0.968
Plestiodon gilberti	pg1	run	10	3.14	0.0516	8.8	0.00089	42.4	1.1	34.7	18.3	0.965
Takydromus septentrionalis	ts1	run	14	2.22	0.0928	17.7	0.00165	42.3	0.8	32.8	21.9	0.936
Takydromus sexlineatus	tsex	run	12	2.14	0.0909	26.2	0.00402	42.0	0.9	33.6	18.7	0.892
Gallotia stehlini	gst	run	7	2.95	0.1409	15.3	0.00124	43.7	3.2	35.9	18.5	0.929
Gambelia wislizenii	gwis	run	8	2.67	0.1740	19.7	0.00162	44.5	3.4	36.3	19.2	0.892
Eremias brenchleyi	ebren	run	12	2.15	0.2098	11.6	0.00097	43.7	1.5	33.2	24.7	0.939
Eremias argus	earg	run	13	2.26	0.1700	7.6	0.00072	44.9	1.4	34.6	24.5	0.977
Sceloporus occidentalis	scelocc	run	9	2.24	0.3467	15.4	0.00110	45.6	3.4	35.6	23.4	0.953
Dipsosaurus dorsalis	dipdors	run	8	2.69	0.1767	18.7	0.00113	48.4	4.5	40.0	20.0	0.922
Anolis intermedius	anint	run	5	2.98	0.0616	15.6	0.00192	38.4	1.0	31.0	17.3	0.933
Anolis humilis	anhum	run	5	3.69	0.0446	16.9	0.00285	35.6	1.1	29.4	14.4	0.948
Liolaemus baguali	Lbag	run	7	2.85	0.1065	17.0	0.00143	43.5	2.2	35.6	18.6	0.995
Liolaemus gallardoi	Lgal	run	7	2.34	0.1586	17.6	0.00144	44.0	1.8	34.8	21.5	0.964
Liolaemus hatcheri	Lhat	run	7	2.65	0.1004	17.7	0.00156	43.1	1.6	34.8	19.4	0.987
Liolaemus kingii	Lkin	run	7	2.39	0.2019	17.1	0.00137	44.1	2.4	35.0	21.4	0.976
Liolaemus kolengh	Lkol	run	7	2.31	0.1295	15.5	0.00124	44.0	1.3	34.4	22.3	0.978
Liolaemus magellanicus	Lmag	run	7	2.17	0.1348	16.1	0.00134	43.5	1.1	33.5	23.2	0.939
Liolaemus zullyi	Lzu	run	7	2.42	0.1325	17.6	0.00145	43.9	1.6	34.9	20.9	0.973
Acarus farris	af	fit	6	4.77	0.0113	10.7	0.00271	29.9	0.3	24.6	12.7	0.979
Aphelinus semiflavus	as	fit	6	5.57	0.0093	16.4	0.00956	26.6	0.3	22.3	9.7	0.866
Aphis gossypii	ag1	fit	6	2.32	0.0467	15.1	0.00166	39.7	0.4	30.5	21.1	0.868
Aphis gossypii	ag2	fit	8	3.07	0.0402	16.1	0.00337	33.3	0.5	26.5	15.5	0.952
Aphis gossypii	ag3	fit	5	3.83	0.0236	13.0	0.00251	32.9	0.4	26.8	14.4	0.986
Busseola fusca	bf1	fit	6	3.42	0.0105	24.2	0.01162	33.5	0.3	28.5	11.3	0.974
Busseola fusca	bf2	fit	6	4.09	0.0076	19.7	0.00400	35.5	0.3	29.9	13.0	0.989
Cactoblastis castorum	cc	fit	5	4.65	0.0010	20.9	0.00503	35.0	0.1	29.9	11.8	0.970
Calandra oryzae	co	fit	9	4.27	0.0021	21.0	0.00531	34.7	0.1	29.4	12.1	0.870
Cotesia plutellae	cp	fit	6	4.05	0.0098	16.6	0.00296	35.0	0.3	29.2	13.7	0.984
Cryptolestes ferrugineus	cf	fit	9	3.79	0.0019	24.4	0.00353	41.2	0.1	35.3	13.7	0.884
Dactylopius austrinus	da	fit	7	5.21	0.0017	21.4	0.00509	35.4	0.2	30.6	11.2	0.996
Diaphorina citri	dc	fit	5	3.78	0.0059	25.5	0.02871	31.4	0.2	27.5	9.1	0.993
Ebcarsia bimaculata	eb	fit	5	4.10	0.0050	22.4	0.00597	35.3	0.2	30.0	12.0	0.992
Eretmocerus furuhashii	efu	fit	5	6.93	0.0010	21.4	0.00614	34.2	0.2	30.0	9.8	0.954
Gonatocerus triguttatus	gt	fit	5	4.10	0.0081	19.4	0.00412	35.0	0.3	29.4	12.9	0.932
Hyperaspis notata	hn1	fit	6	4.22	0.0027	19.2	0.00459	33.9	0.1	28.5	12.5	0.893
Hyperaspis notata	hn2	fit	6	3.42	0.0036	26.1	0.01627	34.0	0.1	29.3	10.6	0.920
Hypothenemus hampei	hh	fit	5	4.22	0.0038	21.6	0.00919	32.0	0.1	27.2	10.8	0.849
Liposcelis badia	lb	fit	7	2.39	0.0037	25.1	0.00993	35.1	0.0	28.8	14.4	0.888
Liposcelis decolor	ld	fit	8	2.07	0.0056	31.8	0.02720	37.9	0.1	33.1	13.7	0.961
Liposcelis entomophila	le	fit	7	3.65	0.0017	23.1	0.00527	36.9	0.1	31.2	12.9	0.838
Liposcelis paeta	lp	fit	7	3.27	0.0014	23.0	0.00282	41.8	0.1	35.2	15.4	0.915
Liposcelis tricolor	lt	fit	7	4.14	0.0006	25.0	0.00864	35.8	0.0	30.9	11.1	0.859
Liriomyza sativae	ls1	fit	5	3.66	0.0080	18.5	0.00366	35.0	0.2	29.0	13.9	0.950
Macrolophus pygmaeus	mp1	fit	5	3.46	0.0060	16.8	0.00401	32.6	0.1	26.5	14.0	0.999

Macrolophus pygmaeus	mp2	fit	5	2.40	0.0109	24.9	0.02084	31.8	0.1	26.8	12.6	0.998
Macrosiphum euphorbiae	me	fit	6	2.34	0.0478	10.8	0.00273	29.9	0.2	21.5	19.0	0.966
Myzus persicae	Mp2	fit	6	3.29	0.0508	11.7	0.00300	30.0	0.5	23.4	15.2	0.974
Myzus persicae	Mp3	fit	7	3.98	0.0181	7.0	0.00159	32.1	0.3	25.9	14.9	0.890
Paronychiurus kimi	pk	fit	5	5.17	0.0026	15.8	0.00547	29.3	0.1	24.5	11.1	0.968
Phyllonorycter corylifoliella	pc	fit	5	3.21	0.0065	17.6	0.00350	34.5	0.1	28.0	15.0	0.985
Rhizopertha dominica	rd	fit	6	7.24	0.0003	21.0	0.00318	38.7	0.1	34.4	10.4	0.965
Sesamia calamistis	sc1	fit	6	3.08	0.0125	24.5	0.01177	33.8	0.3	28.5	11.9	0.822
Sesamia calamistis	sc2	fit	6	3.31	0.0115	23.9	0.00702	35.8	0.3	30.1	12.8	0.995
Sesamia nonagrioides	sn1	fit	6	2.90	0.0146	24.1	0.01081	33.7	0.2	28.1	12.5	0.882
Sesamia nonagrioides	sn2	fit	6	3.47	0.0121	19.4	0.00381	35.6	0.3	29.4	14.2	0.962
Sitobion miscanthi	sm	fit	5	4.89	0.0122	14.0	0.00468	28.7	0.3	23.7	11.7	0.999
Stethorus punctillum	Sp	fit	8	8.63	0.0006	16.9	0.00343	34.0	0.2	30.0	9.6	0.948
Thrips tabaci	tt	fit	5	3.17	0.0108	22.4	0.01588	30.3	0.2	25.4	11.1	1.000
Toxoptera citricidus	tc	fit	7	3.89	0.0151	21.0	0.01018	30.9	0.4	26.0	11.0	0.895
Trichogramma bruni	Tb	fit	5	2.56	0.0201	25.3	0.01056	35.0	0.3	29.1	13.6	0.999
Trichogramma mwanzai	Tm	fit	5	2.73	0.0270	20.5	0.00428	35.8	0.3	28.8	15.7	0.962
Trichogramma pretoisum	tp1	fit	6	4.00	0.0097	21.5	0.00570	34.7	0.4	29.4	12.2	0.984
Trichogrammatoidea lutea	tl	fit	5	3.71	0.0100	26.5	0.01062	36.2	0.5	31.2	11.1	0.989
Trioxys utilis	tu	fit	6	8.80	0.0059	15.3	0.00771	26.7	0.5	23.0	8.7	0.974
Tetraneura nigriabdominalis	tn	fit	5	6.62	0.0029	12.9	0.00245	33.1	0.3	28.5	11.1	0.990