Electronic Supplemental Material for Ord & Blazek (2026) Oecologia [https://doi.org/10.1007/s00442-026-05959-6] 'Limits on the capacity of an ectotherm to buffer temperature extremes through the construction of a central refuge'

ADDITIONAL MATERIALS AND METHODS

Phylogenetic positioning of taxa not represented in the Nelsen et al. (2018, 2023) phylogeny

We used several methods to phylogenetically position unrepresented taxa. First, taxa replaced species of the same genus with the closest geographic distribution (based on data from www.AntiWiki.org). Second, instances where there was only a single species of the same genus that was also included in our data set, taxa were positioned immediately adjacent to this species with a branch length averaged from those of the closest phylogenetic genus. This average included only branches within this genus that lead directly to terminal taxa at the tip of the phylogeny (i.e., internal branch lengths within the genus were not included in the calculation). Third, taxa replaced the single species of the same genus represented on the phylogeny if this species was not included in our data set. Fourth, if geographic information was not available for the unrepresented taxa or species represented on the phylogeny, taxa arbitrarily replaced a species within the same genus on the phylogeny. Finally, in one instance, a taxa (*Solenopsis invicta*) replaced a species (*Mayriella transfuga*) represented on

the Nelsen phylogeny based on the phylogenetic information reported in Moreau et al (2006). Details on the phylogenetic assignment of individual taxa are describe below.

Aphaenogaster sp. 1 nests used to estimate brood incubation temperature were originally collected by Mezger and Pfeiffer (2010) in Sarawak, Malaysia and the species was subsequently positioned on the phylogeny in replace of *Aphaenogaster pythia*, the closest geographic species of the same genus.

Atta sexdens rubropilosa nests used to estimate brood incubation temperature were collected in Sao Paulo State, Brazil by Camargo et al. (2016) and the species was positioned on the phylogeny in replace of *Atta cephalotes*, the closest geographic species of the same genus.

Acanthomyrmex concavus was positioned on the phylogeny as a sister species to *A. ferox*, with a branch length averaged from those of the phylogenetically adjacent genus *Lordomyrma*.

Camponotus mus nests used to estimate brood incubation temperature were collected in Uruguay by Falibene et al. (2016; see also Roces and Nunez 1995) and the species was positioned on the phylogeny in replace of *C. renggeri,* the closest geographic species of the same genus.

Cataglyphis niger replaced *C. aenescens*, the single species from the genus represented on the phylogeny.

Cerapachys sp. 4 replaced *C. jacobsoni*, the single species from the genus represented on the phylogeny.

Cerapachys sp. 6 was positioned on the phylogeny as a sister species to *Cerapachys* sp. 4 (see above), with a branch length averaged from those of the phylogenetically adjacent genus *Aenictus*.

Gnamptogenys palamala replaced *G. striatula*, the single species from the genus represented on the phylogeny.

Hypoponera sp. 11 arbitrarily replaced *H. johannae* because there was no geographic information available for species represented on the phylogeny from the same genus.

Hypoponera sp. 15 was positioned on the phylogeny as a sister species to *Hypoponera* sp. 11 (see above), with a branch length averaged of those species from the same genus represented on the phylogeny.

Lasius japonicus arbitrarily replaced *L. latipes* because there was no geographic information available for species represented on the phylogeny from the same genus.

Leptogenys sp. 3 nests used to estimate brood incubation temperature were originally collected by Mezger and Pfeiffer (2010) in Sarawak, Malaysia and the species was subsequently positioned on the phylogeny in replace of *L. iridescens*, the closest geographic species of the same genus.

Leptogenys sp. 7 nests used to estimate brood incubation temperature were originally collected by Mezger and Pfeiffer (2010) in Sarawak, Malaysia and the species was subsequently positioned on the phylogeny in replace of *L. crassicornis*, the closest geographic species of the same genus.

Linepithema humile arbitrarily replaced *L. angulatum* because there was no geographic information available for species represented on the phylogeny from the same genus.

Lophomyrmex bedoti replaced *L. ambiguus*, the single species from the genus represented on the phylogeny.

Lophomyrmex longicornis was positioned on the phylogeny as a sister species to *L. bedoti* (see above), with a branch length averaged of those species from the same genus represented on the phylogeny.

Myopias sp. 1 replaced *Myopias tenuis*, the single species from the genus represented on the phylogeny.

Myrmecina nipponica arbitrarily replaced *M. americana* because there was no geographic information available for species represented on the phylogeny from the same genus.

Myrmecina sp. 1 arbitrarily replaced *M. graminicola* because there was no geographic information available for species represented on the phylogeny from the same genus.

Myrmica rubra nests used to estimate brood incubation temperature were originally collected by Kipyatkov and Lopatina (2002) in Ukraine and the species was subsequently positioned on the phylogeny in replace of *M. punctiventris* and immediately adjacent to *M. ruginodis*, both of which are the closest geographic species of the same genus.

Pachycondyla pilidorsalis replaced *P. harpax*, the single species from the genus represented on the phylogeny.

Paratrechina longicornis arbitrarily replaced *P. zanjensis* because there was no geographic information available for species represented on the phylogeny from the same genus.

Paratrechina sp. 1 arbitrarily replaced *P. antsingy* because there was no geographic information available for species represented on the phylogeny from the same genus.

Paratrechina sp. 5 arbitrarily positioned as the immediate sister taxa to *Paratrechina* sp. 1, with a branch length averaged from that of *Paratrechina longicornis* and *Paratrechina* sp. 1 (see above).

The following species where brood incubation temperature were estimated from nests originally collected by Mezger and Pfeiffer (2010) in Sarawak, Malaysia, arbitrarily replaced species within the same genus that similarly had geographic distributions within Sarawak (e.g., *Pheidole lucioccipitalis*, *P. morrisi* and *P. quadrensis*): *P. aglae* replaced *P. militicida*;

P. annexus replaced *P. sabahna*; *P. aristotelis* replaced *P. nodus*; *P. cariniceps* replaced *P. dugasi*; *P. poringensis* replaced *P. tjibodana*; *P. quadricuspis* replaced *P. jacobsoni*; *P. rugifera* replaced *P. dea*; and *P. upenec* replaced *P. nigeriensis.*

Pheidologeton pygmaeus is a synonym of *Carebara pygmaea* and arbitrarily replaced *C. vidua* because there was no geographic information available for species represented on the phylogeny from the same genus.

Platythyrea sp. 1 arbitrarily replaced *P. conradti* because there was no geographic information available for species represented on the phylogeny from the same genus.

Pogonomyrmex salinus arbitrarily replaced *P. saucius* because there was no geographic information available for species represented on the phylogeny from the same genus.

Strumigenys rofocala arbitrarily replaced *S. exiguaevitae* because there was no geographic information available for species represented on the phylogeny from the same genus.

Technomyrmex lisae arbitrarily replaced *T. innocens* because there was no geographic information available for species represented on the phylogeny from the same genus.

Technomyrmex modiglianii arbitrarily replaced *T. anterops* because there was no geographic information available for species represented on the phylogeny from the same genus.

Temnothorax nylanderi arbitrarily replaced *T. kutteri* because there was no geographic information available for species represented on the phylogeny from the same genus.

The following species arbitrarily replaced a group of closely-related species within the same genus because there was no geographic information available for species represented on the phylogeny from the same genus: *Tetramorium meshena* replaced *T. scytalum*; *T. pacificum* replaced *T. taylori*; *Tetramorium* sp (*near vertigum*) replaced *T. venator*; and *T. tonganum* replaced *T. validiusculum*.

Solenopsis invicta replaced *Mayriella transfuga* because this species was identified as a sister taxa to this latter species by Moreau et al (2006).

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Table S1. Brood incubation temperatures reported in the literature for 59 ant taxa. Information on region and nest type were used in evolutionary regressions as additional predictor variables. Details on how authors determined the ideal (optimal) incubation temperature for a species is clarified in the 'notes' column.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Acanthomyrmex concavus	Sarawak, Malaysia	tropical	tree	30.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Acanthomyrmex ferox	Sarawak, Malaysia	tropical	various	27.8	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Acromyrmex heyeri	Canelones, Uruguay	temperate	various	22.6	lab	preferred temperature for brood, taken as the midpoint between two temperature preferences (20.8C and 24.4C) estimated based on 10C and 37C starting points	Bollazzi and Roces 2002
Aphaenogaster senilis	Iberian Peninsula	temperate	soil	30	lab	optimal temperature for shortest number of days to produce workers based on three treatments (24C, 27C and 30C)	Boulay et al. 2009
Aphaenogaster sp. 1	Sarawak, Malaysia	tropical	deadwood	25.8	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Atta sexdens rubropilosa	Sao Paulo State, Brazil	tropical	soil	28	lab	optimal temperature for worker production based on four temperature treatments (15C, 20C, 24C and 28C)	Camargo et al. 2016

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Camponotus mus	La Coronilla, Uruguay / Buenos Aires, Argentina	subtropical	various	28.6	lab	Falibene: optimal temperature for colonies that produce pupae that survive; Roces and Nunez: preferred temperature for brood, taken as the midpoint between two means (27.5C and 30.8C)) used Falibene because of larger sample size	Falibene et al. 2016; Roces and Nunez 1995
Camponotus rufpes	Sao Paulo State, Brazil	tropical	deadwood	25	lab	preferred temperature for brood	Roces and Nunez 1995
Cataglyphis niger	Tel Aviv, Israel	subtropical	soil	28	lab	optimal temperature based on total duration starting at 28C then dropped to 22C	Bar et al. 2022
Cerapachys sp. 4	Sarawak, Malaysia	tropical	various	24.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Cerapachys sp. 6	Sarawak, Malaysia	tropical	various	22.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Crematogaster modiglianii	Sarawak, Malaysia	tropical	deadwood	24.3	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Eciton burchellii	Barro Colorado, Panama Canal	tropical	none	28	field	preferred temperature for brood based on location of the majority of the brood in natural nests	Jackson 1957; Franks 1989

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Gnamptogenys palamala	Sarawak, Malaysia	tropical	deadwood	23.8	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Hypoponera sp. 11	Sarawak, Malaysia	tropical	leaves	28.2	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Hypoponera sp. 15	Sarawak, Malaysia	tropical	deadwood	28.6	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Labidus praedator	Costa Rica	tropical	soil	21.8	field	preferred temperature for brood based on location of the majority of the brood in natural nests at 30-40 cm depth	Baudier and O'Donnell 2016
Lasius japonicus	Okayama, Japan	subtropical	various	25	lab	optimal rearing temperature producing larvae or emerged pupae based on three to four temperatures used (15, 17.5, 20 and 25)	Nakamura et al. 2017; Kuroki et al. 2018; Kuroki et al. 2019
Leptogenys sp. 3	Sarawak, Malaysia	tropical	various	22.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Leptogenys sp. 7	Sarawak, Malaysia	tropical	leaves	19.1	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Linepithema humile	Iberian Peninsula	temperate	various	28	lab	optimal temperature for oviposition	Abril et al. 2008
Lophomyrmex bedoti	Sarawak, Malaysia	tropical	various	20.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Lophomyrmex longicornis	Sarawak, Malaysia	tropical	various	23.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Myopias sp. 1	Sarawak, Malaysia	tropical	deadwood	29.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Myrmecina nipponica	Hokkaido University, Japan	temperate	soil	5	lab	optimal temperature for worker and queen production based on two temperature treatments (5 and 20C)	Murakami et al. 2002
Myrmecina sp. 1	Sarawak, Malaysia	tropical	tree	29.1	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Myrmica rubra	Ukraine / Russia	temperate	deadwood	24	lab	optimal temperature for production of brood, both in number and shortest development time, based on six treatment temperatures (16, 18, 20, 22, 24 and 26C)	Kipyatkov and Lopatina 2002
Myrmica ruginodis	Ukraine / Russia	subartic	deadwood	24	lab	optimal temperature for production of brood, both in number and shortest development time, based on six treatment temperatures (16, 18, 20, 22, 24 and 26C)	Kipyatkov and Lopatina 2002

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Myrmica scabrinodis	Russia	subartic	soil	24	lab	optimal temperature for production of brood, both in number and shortest development time, based on six treatment temperatures (16, 18, 20, 22, 24 and 26C)	Kipyatkov and Lopatina 2002
Odontomachus rixosus	Sarawak, Malaysia	tropical	deadwood	25.3	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pachycondyla pilidorsalis	Sarawak, Malaysia	tropical	various	22.6	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Paratrechina longicornis	Sarawak, Malaysia	tropical	various	27.3	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Paratrechina sp. 1	Sarawak, Malaysia	tropical	various	30.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Paratrechina sp. 5	Sarawak, Malaysia	tropical	deadwood	21.9	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole aglae	Sarawak, Malaysia	tropical	various	25.4	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole annexus	Sarawak, Malaysia	tropical	various	27.6	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole aristotelis	Sarawak, Malaysia	tropical	various	27.6	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole cariniceps	Sarawak, Malaysia	tropical	various	28.1	lab	preferred temperature for brood	Mezger and Pfeiffer 2010

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Pheidole lucioccipitalis	Sarawak, Malaysia	tropical	various	20.4	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole morrisi	Florida, USA	subtropical	soil	25	field	preferred temperature for brood, based on exervated nests with corresponding internal temperatures at depth where brood was primarily found	Murdock and Tschinkel 2015
Pheidole poringensis	Sarawak, Malaysia	tropical	sticks	25.5	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole quadrensis	Sarawak, Malaysia	tropical	various	28	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole quadricuspis	Sarawak, Malaysia	tropical	deadwood	24.4	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole rugifera	Sarawak, Malaysia	tropical	sticks	29.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole sauberi	Sarawak, Malaysia	tropical	leaves	29.8	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidole upeneci	Sarawak, Malaysia	tropical	sticks	17.9	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Pheidologeton pygmaeus	Sarawak, Malaysia	tropical	deadwood	27.9	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Platythyrea sp. 1	Sarawak, Malaysia	tropical	various	24.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Pogonomyrmex salinus	Idaho, USA	temperate	soil	32.8	lab	preferred temperature for brood, taken as the midpoint between two temperature depths where most of the brood was found (29.2, 36.4)	Anderson and Munger 2003
Polyrhachis (Myrma) equina	Sarawak, Malaysia	tropical	deadwood	29.6	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Solenopsis invicta	Louisiana, USA	subtropical	soil	28	field	presence of broods in nests in the field (preferred over Porter 1988 who tested a small number of colonies in the lab)	Pranschke and Hooper-Bui 2003; Porter 1988
Strumigenys rofocala	Sarawak, Malaysia	tropical	tree	30.5	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Technomyrmex lisae	Sarawak, Malaysia	tropical	various	27.5	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Technomyrmex modiglianii	Sarawak, Malaysia	tropical	various	16.9	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Temnothorax nylanderi	Paris, France	temperate	various	20	lab	optimal temperature for worker production based on two temperature treatments (20, 27)	Molet et al. 2017
Tetramorium meshena	Sarawak, Malaysia	tropical	deadwood	27.7	lab	preferred temperature for brood	Mezger and Pfeiffer 2010

Table S1. Continued.

species	location	region	nest type	optimal incubation temperature (oC)	setting	notes	source
Tetramorium pacificum	Sarawak, Malaysia	tropical	deadwood	26	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Tetramorium sp (*vertigum*)	Sarawak, Malaysia	tropical	deadwood	17.2	lab	preferred temperature for brood	Mezger and Pfeiffer 2010
Tetramorium tonganum	Sarawak, Malaysia	tropical	sticks	16	lab	preferred temperature for brood	Mezger and Pfeiffer 2010

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Table S2. Nest temperature as a function of depth across ant taxa that excavate soil nests. Data were compiled from reports measuring nest temperatures during summer. In the case of the meat ant (*I. purpureus*), data were extracted for the main survey conducted in spring (September, over 4 days) as well as the pilot survey conducted in summer (February, over 2 days; Ettershank 1971).

species	depth (cm)	temperature estimate	nest temperature (ºC)	N_{nest}	source
Atta sexdens rubropilosa	0	mean, daily	24.91	1	Camargo et al. (2016)
Atta sexdens rubropilosa	5	mean, daily	26.77	1	Camargo et al. (2016)
Atta sexdens rubropilosa	25	mean, daily	24.21	1	Camargo et al. (2016)
Atta sexdens rubropilosa	45	mean, daily	26.22	1	Camargo et al. (2016)
Atta sexdens rubropilosa	150	mean, daily	25.53	1	Camargo et al. (2016)
Camponotus detritus	0	point sample	57.25	1	Curtis (1985)
Camponotus detritus	14	point sample	34.01	1	Curtis (1985)
Camponotus detritus	22	point sample	29.7	1	Curtis (1985)
Formica exsectoides	0	point sample	28	1	Bristow et al (1992)
Formica exsectoides	20	point sample	23	1	Bristow et al (1992)
Formica exsectoides	40	point sample	22	1	Bristow et al (1992)
Formica exsectoides	60	point sample	22	1	Bristow et al (1992)
Formica exsectoides	80	point sample	17	1	Bristow et al (1992)
Formica exsectoides	100	point sample	16	1	Bristow et al (1992)
Formica exsectoides	120	point sample	16	1	Bristow et al (1992)
Formica exsectoides	140	point sample	16	1	Bristow et al (1992)
Formica polyctena	0	mean, daily	25.155	1	Brandt (1980)
Formica polyctena	5	mean, daily	23.92	1	Brandt (1980)
Formica polyctena	10	mean, daily	23.457	1	Brandt (1980)
Formica polyctena	20	mean, daily	23.303	1	Brandt (1980)
Formica polyctena	30	mean, daily	20.53	1	Brandt (1980)
Formica rufa	0	mean, daily	14.55	1	Rosengren et al. (1987)
Formica rufa	30	mean, daily	29.101	1	Rosengren et al. (1987)
Formica rufa	60	mean, daily	20.506	1	Rosengren et al. (1987)
Formica rufa	0	mean	21.6	5	Stukalyuk et al. (2020)
Formica rufa	10	mean	23.7	5	Stukalyuk et al. (2020)
Formica rufa	0	mean	21.8	5	Stukalyuk et al. (2020)
Formica rufa	40	mean	26.2	5	Stukalyuk et al. (2020)
Formica rufa	0	mean	22	5	Stukalyuk et al. (2020)
Formica rufa	40	mean	26.8	5	Stukalyuk et al. (2020)

Table S2. Continued.

species	depth (cm)	temperature estimate	nest temperature (ºC)	N_{nest}	source
Formica rufa	0	median	20.206	10	Balzani et al. (2022)
Formica rufa	20	median	20.348	10	Balzani et al. (2022)
Formica rufa	40	median	21.234	10	Balzani et al. (2022)
Formica rufa	60	median	22.658	10	Balzani et al. (2022)
Formica rufa	80	median	23.544	10	Balzani et al. (2022)
Formica rufa	90	median	23.465	10	Balzani et al. (2022)
Iridomyrmex purpureus	2.5	mean, daily max (spring)	38.95	1	Ettershank (1971)
Iridomyrmex purpureus	7.6	mean, daily max (spring)	34.125	1	Ettershank (1971)
Iridomyrmex purpureus	23	mean, daily max (spring)	24.9	1	Ettershank (1971)
Iridomyrmex purpureus	38	mean, daily max (spring)	20.425	1	Ettershank (1971)
Iridomyrmex purpureus	0	mean, daily max (summer)	59.322	1	Ettershank (1971)
Iridomyrmex purpureus	10	mean, daily max (summer)	37.131	1	Ettershank (1971)
Proformica longiseta	0	point sample	51.637	1	Escudero et al (1997)
Proformica longiseta	30	point sample	16.98	1	Escudero et al (1997)

TABLE S2 REFERENCES

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Table S3. Support for alternative models differing in random effects for probe applied to (a) minimum and (b) maximum daily temperature recorded 1 cm above the nest surface and at a depth of 7 cm inside the nest over 12 weeks. See also Tables 1 and S5. Those models with the lowest AIC value are considered to be the best supported, although any model within 2 AIC units of this model (i.e., ≤2.0 ΔAIC) are equally credible.

model	AIC	ΔAIC
(a) minimum daily temperatures		
random intercept + slope	2480.92	6.00
random intercept	2476.92	2.00
no random effects	2474.92	0.00
(b) maximum daily temperature		
random intercept + slope	3152.22	4.00
random intercept	3148.22	0.00
no random effects	3152.82	4.59

Table S4. Support for alternative models differing in random effects for probe applied to (a) minimum and (b) maximum daily temperature on and off the nest recorded 1 cm above the nest/soil surface versus at a depth of 7 cm over 4 weeks. Those models with the lowest AIC value are the best supported.

model	AIC	ΔAIC
(a) minimum daily temperatures		
random intercept + slope	1087.71	4.00
random intercept	1083.71	0.00
no random effects	1086.82	3.11
(b) maximum daily temperature		
random intercept + slope	1421.67	3.98
random intercept	1417.69	0.00
no random effects	1472.51	54.82

Table S5. Differences in minimum daily temperature over 12 weeks recorded 1 cm above the nest surface and at a depth of 7 cm inside the nest based on a model with no random effects (see Table 1 for the equivalent model applied with a random intercept for probe). XI was the most 'exposed' nest, XCIII the most 'sheltered' nest, and III between the two as the 'moderate' nest. K refers to the knot number used for the spline smoothing term associated with daily changes in temperature.

variable	estimate (95% confidence range)	*t*	*F*	*p*
separate				
intercept (nest III)	23.22 (22.83, 23.62)	116.2		< 0.0001
nest XCIII	-0.01 (-0.49, 0.47)	-0.03		0.98
nest XI	-0.24 (-0.72, 0.24)	-0.98		0.33
depth (surface vs internal)	-7.23 (-7.63, -6.84)	-36.19		< 0.0001
overall				
nest			0.62	0.54
depth			1310.01	< 0.0001
smoothing term (date)			165.5	< 0.0001
$N_{observations,\ nests,\ depth}$=540, 3, 2				
k = 5				

Table S6. Differences in minimum daily temperature on and off the nest recorded 1 cm above the nest/soil surface versus at a depth of 7 cm over 4 weeks. The model applied includes a random intercept for the probe recording data and an interaction for probe depth and location (on versus off the nest). XI was the most 'exposed' nest while XCIII was the most 'sheltered' nest. See also Table 2.

variable	estimate (95% confidence range)	*t*	*p*
intercept (nest XCIII)	20.37 (19.22, 21.52)	34.8	< 0.0001
nest XI	0.07 (-0.96, 1.09)	0.13	0.90
depth (surface vs internal)	-6.32 (-7.77, -4.87)	-8.53	< 0.0001
location (on vs off nest)	-0.07 (-1.52, 1.38)	-0.10	0.92
depth * location	-0.72 (-2.77, 1.34)	-0.68	0.50

Table S7. Support for alternative OU evolutionary models of brood incubation temperature described as the phylogenetic mean (null model) or as a function of climate zone, material used to construct nests, or their combination (see Table S1). The model with the lowest AIC value is the best supported.

OU model applied	AIC_c	ΔAIC_c	$N_{species}$
null (intercept only)	353.6	0	59
climate zone	358.5	4.9	59
nest type	362.9	9.3	59
nest type + climate zone	369.6	16	59

Figure S1. Naturally predated meat ant nests by echidna. Excavations into the nest correspond to the position of the brood within the nest at the time of predation. These examples were fresh and likely occurred within one or two weeks of the photograph being taken. Depth was inferred based on a ruler or object of known size being placed in the excavation in an image taken immediately prior, which was then measured using imageJ (imagej.nih.gov/ij) to calculate the depth range in the images shown.