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Supplementary Material

High night temperature induces contrasting responses for spikelet fertility, spikelet tissue temperature, flowering characteristics and grain quality in rice

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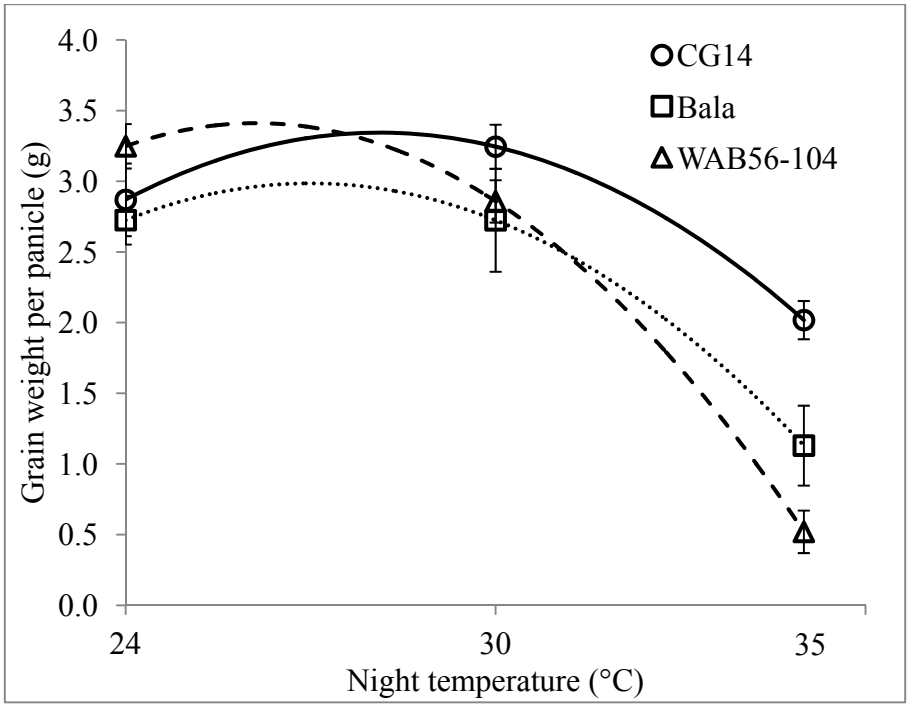

Fig. S1. Effect of night temperature (from microsporogenesis to three days after anthesis) on grain weight per panicle (g) of three contrasting rice cultivars showing no response to DT (Table 3). Symbols combine results for 30 and 35 ºC DT at anthesis for each of CG14 (solid line, circles); Bala (dotted line, squares); WAB56-104 (broken line, triangles). Vertical bars represent ±s.e. about the mean (*n*=16) where larger than symbols (Experiment 4).

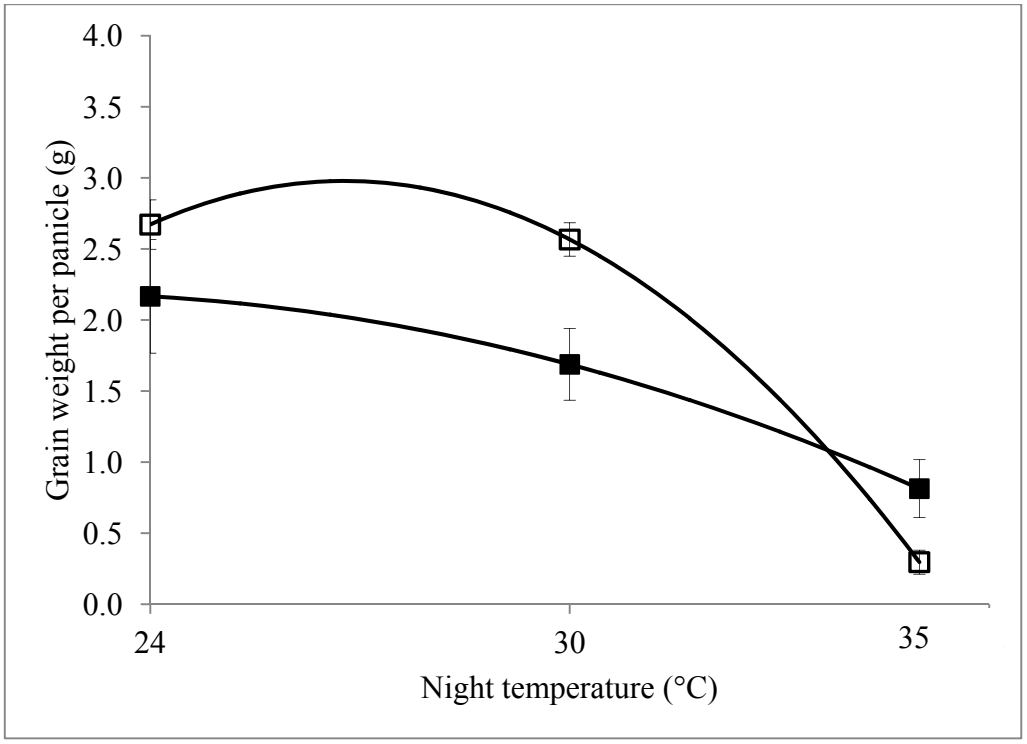

Fig. S2. Effect of night temperature (from microsporogenesis to three days after anthesis) on grain weight per panicle (g) of cv. IR64 at either 30 (solid squares) or 35 ºC (open squares) DT (5-6 h at anthesis). The responses are quantified in Table 3. Vertical bars represent ±s.e. about the mean (*n*=7) where larger than symbols (Experiment 4).

Table S1. Parameter estimates of separate line regression models for response of spikelet anthesis duration of CG14 and N22 to night temperature (NT)

n = 24 per cultivar (Experiment 2)

	CG14			N22		
Parameters	Estimate	s.e.	*P*	Estimate	s.e.	*P*
Day 1 (intercept)	31.43	7.99	<0.001	55.99	3.79	<0.001
Day 2 (intercept)	5.43	7.99	0.502	44.73	3.79	<0.001
Day 4 (intercept)	51.58	7.99	<0.001	23.37	3.79	<0.001
NT x Day 1 (slope)	0.46	0.27	0.096	-0.52	0.13	<0.001
NT x Day 2 (slope)	1.33	0.27	<0.001	-0.10	0.13	0.446
NT x Day 4 (slope)	-0.07	0.27	0.794	0.67	0.13	<0.001
Adjusted R^{2*}	0.48	0.04		0.60	0.02	

*The single R^2 value for each cultivar is of the full regression model – (individual factors and their interactions).

Table S2. Time of start of anthesis and cumulative percentage of anthesed spikelets at time of peak anthesis of three rice cultivars

Rice cultivars were treated to two different periods of exposure (early, 1830 to 0000; or late, 0000 to 0530) to three night temperatures from the first to fourth day of anthesis (Experiment 3)

Time of start of anthesis	CG14		N22		WAB56-104	
Night temperature (°C)	Early	Late	Early	Late	Early	Late
24	0530	0530	0800	0630	0800	0530
30	0530	0530	0800	0600	0600	0600
35	0530	0530	0800	0600	0530	0500

Cumulative anthesed spikelets at time of peak anthesis (%)[A]			
Night temperature (°C)	CG14	N22	WAB56-104
24	59 ±2	71 ±12	84 ±6
30	61 ±5	77 ± 7	69 ±6
35	53 ±7	66 ±12	58 ±9
LSD (5%)	16	30	20
Time of night (EST)			
1830–0000	57 ±4	71 ±7	75 ±4
0000–0530	59 ±5	72 ±9	66 ±8
LSD (5%)	13	23	17

[A]Values are means ± s.e. of means of six main panicles observed for three days from the time of start of anthesis.

Table S3. Associations (Spearman's rank correlation) for spikelet fertility amongst different high day and night temperatures regimes (Experiment 4)

Day/night temperature (°C) combination		Correlation	*P*	Explanation
High day (35/24)				
	30/30 HNT[A]	0.745	0.004	Associated
	30/35 vHNT[B]	0.515	0.031	Associated
	35/30 HDT[C]+HNT	–0.006	0.243	Not associated
	35/35 HDT+vHNT	0.285	0.102	Not associated
High night (30/35)				
	30/30 HNT	0.612	0.015	Associated
	35/30 HDT+HNT	0.515	0.031	Associated
	35/35 HDT+vHNT	0.661	0.010	Associated

[A]HNT = high night temperature (30°C).

[B]vHNT = very high night temperature (35°C).

[C]HDT = high day temperature (35°C).

Table S4. Estimates of regression parameters for the response of (square root [√+0.5] transformed) grain weight per panicle (g) to night temperature (Experiment 4)

Cultivar	Constant ±s.e.	Linear term ±s.e.	Quadratic term ±s.e.	NT_c[A] (°C)
Equations for single curve for both DT				
CG14	–5.42±1.99	0.516±0.138	–0.00905±0.00234	28.5
IR36	–12.26±2.96	1.004±0.204	–0.01782±0.00346	28.2
Bala	–8.46±3.39	0.756±0.235	–0.01370±0.00399	27.6
Lemont	–13.01±2.81	1.109±0.195	–0.02017±0.00330	27.5
N22	–6.37±2.01	0.610±0.139	–0.01122±0.00236	27.2
Azucena	–13.29±3.82	1.151±0.265	–0.02123±0.00449	27.1
WAB56-104	–9.10±2.34	0.825±0.162	–0.01537±0.00275	26.8
LSD	7.06[NS]	0.479*	0.00800*	1.8[NS]
Equations for parallel and separate curves				
DT = 30°C				
Moroberekan[B]	–5.71±2.84	0.629±0.196	–0.01180±0.00333	26.7
Co39[B]	–8.24±2.51	0.754±0.174	–0.01422±0.00295	26.5
IR64[C]	–2.64±2.98	0.327±0.206	–0.00627±0.0035	26.1
LSD	7.86[NS]	0.568[NS]	0.01010[NS]	3.8[NS]
DT = 35°C				
IR64	–9.23±2.98	0.830±0.206	–0.01544±0.00350	26.9
Moroberekan	–5.91±2.84	0.629±0.196	–0.01180±0.00333	26.7
Co39	–8.06±2.51	0.754±0.174	–0.01422±0.00295	26.5
LSD	6.44[NS]	0.453[NS]	0.00782[NS]	1.0[NS]

[A]NT_c = critical night temperature beyond which grain weight per panicle (g) is reduced with further increase in night temperature at both day temperatures was 27°C (±0.2).

[B]= responses of these cultivars at different DT were best fitted by two parallel curves.

[C]= response best fitted by separate curves at different DT.

[NS]= not significant at $P \leq 0.05$; * = $P \leq 0.05$.