



**Fig. S1. Summary results of the effects of experimental treatment and acclimation (means+95% confidence intervals) the mean rate of CO<sub>2</sub> release ( $\dot{V}\text{CO}_2$ ) during an entire DGE cycle.** Acclimation treatment had a significant effect on the mean  $\dot{V}\text{CO}_2$  during a DGE cycle (Wald  $\chi^2=7.972$ , d.f.=3,  $p=0.047$ ). There was a significant relationship between the mean  $\dot{V}\text{CO}_2$  during a DGE cycle and mass ( $p<0.001$ ), therefore mass was included as a covariate. There was no significant interaction between acclimation and experimental treatment.

Table S1. Means and standard errors for the recorded variables for each of the different acclimations (5% O<sub>2</sub>; 40% O<sub>2</sub>; hydrated; dehydrated) at each of the different treatments (5% RH; 90% RH; 5% O<sub>2</sub>; 40% O<sub>2</sub>; control). Mass was a significant covariate in all cases, except for mean O-phase duration and water loss rate. Where mass was a significant covariate the residual data were used to calculate the means. Sample sizes (n) and mean mass for each treatment group within an acclimation are also indicated.

Acclimation	Treatment	n	mean mass (g)	mean duration (min) ± SE			mean V̇CO <sub>2</sub> (ml.h <sup>-1</sup> ) ± SE			CO <sub>2</sub> release volume (ml) ± SE	WLR ± SE (mg.h <sup>-1</sup> )
				DGE cycle	CF-phase	O-phase	DGE cycle	CF-phase	O-phase	O-phase	
5% O <sub>2</sub>	5% RH	10	0.398	65.5±17.0	47.6±12.6	17.1±2.4	0.0346±0.0032	0.0114±0.0019	0.1031±0.0141	0.0291±0.0067	1.549±0.506
	90% RH	7	0.440	49.7±20.4	36.3±15.0	15.8±2.9	0.0382±0.0038	0.0010±0.0022	0.1051±0.0168	0.0250±0.0080	0.240±0.604
	control	7	0.442	58.2±20.4	46.5±15.0	14.5±2.9	0.0351±0.0038	0.0106±0.0022	0.1252±0.0168	0.0238±0.0080	0.320±0.604
	5% O <sub>2</sub>	8	0.368	71.3±19.1	43.2±14.1	24.7±2.7	0.0400±0.0036	0.0138±0.0021	0.0867±0.0157	0.0339±0.0075	0.662±0.565
	40% O <sub>2</sub>	7	0.436	38.2±20.4	30.7±15.0	9.5±2.9	0.0385±0.0038	0.0125±0.0022	0.1347±0.0168	0.0191±0.0080	0.340±0.604
40% O <sub>2</sub>	5% RH	9	0.492	42.4±18.0	33.5±13.3	15.5±2.5	0.0421±0.0034	0.0103±0.0020	0.1452±0.0148	0.0274±0.0070	2.083±0.533
	90% RH	9	0.466	37.4±18.0	26.2±13.3	15.7±2.5	0.0398±0.0034	0.0098±0.0020	0.1132±0.0148	0.0191±0.0070	-0.162±0.533
	control	10	0.286	89.0±17.0	65.0±12.6	13.9±2.4	0.0303±0.0032	0.0090±0.0019	0.1056±0.0141	0.0365±0.0067	0.184±0.506
	5% O <sub>2</sub>	7	0.436	55.9±20.4	33.2±15.0	24.9±2.9	0.0409±0.0038	0.0164±0.0022	0.0869±0.0168	0.0307±0.0080	0.671±0.604
	40% O <sub>2</sub>	8	0.390	58.3±19.1	46.1±14.1	10.6±2.7	0.0289±0.0036	0.0097±0.0021	0.1106±0.0157	0.0218±0.0075	0.451±0.604
hydrated	5% RH	8	0.487	51.6±19.1	34.7±14.1	17.1±2.7	0.0428±0.0036	0.0138±0.0021	0.1030±0.0157	0.0299±0.0075	1.634±0.565
	90% RH	9	0.439	48.1±18.0	32.0±13.3	16.7±2.5	0.0465±0.0034	0.0122±0.0020	0.1197±0.0148	0.0309±0.0070	2.714±0.533
	control	4	0.672	64.2±27.0	45.4±19.9	17.8±3.8	0.0352±0.0050	0.0114±0.0030	0.1086±0.0223	0.0348±0.0106	0.606±0.799
	5% O <sub>2</sub>	6	0.530	50.0±22.0	24.2±16.2	25.7±3.1	0.0497±0.0041	0.0191±0.0024	0.0716±0.0182	0.0322±0.0086	0.881±0.653
	40% O <sub>2</sub>	5	0.448	58.1±24.1	40.6±17.8	18.0±3.4	0.0499±0.0045	0.0128±0.0027	0.1265±0.0199	0.0400±0.0094	1.089±0.715
dehydrated	5% RH	3	0.621	56.8±31.1	38.3±23.0	17.8±4.4	0.0435±0.0058	0.0129±0.0034	0.1119±0.0257	0.0335±0.0122	1.360±0.923
	90% RH	7	0.416	53.1±20.4	33.2±15.0	20.6±2.9	0.0497±0.0038	0.0137±0.0022	0.1253±0.0168	0.0366±0.0080	0.253±0.604
	control	4	0.416	59.8±27.0	36.5±19.9	24.0±3.8	0.0402±0.0050	0.0098±0.0030	0.1031±0.0223	0.0226±0.0106	1.495±0.799
	5% O <sub>2</sub>	3	0.465	63.9±31.1	20.2±23.0	44.1±4.4	0.0553±0.0058	0.0145±0.0034	0.0785±0.0257	0.0586±0.0122	0.591±0.923
	40% O <sub>2</sub>	7	0.441	46.7±20.4	31.4±15.0	15.8±2.9	0.0503±0.0038	0.0162±0.0022	0.1550±0.0168	0.0327±0.0080	1.316±0.604

DGE, discontinuous gas exchange; CF, closed-flutter phase; O, open phase;  $\dot{V}\text{CO}_2$ , rate of  $\text{CO}_2$  release; RH, relative humidity; WLR, water loss rate.

\*Mass was a significant covariate in all cases, except for mean O-phase duration and water loss rate.

Where mass was a significant covariate the residual data were used to calculate mean values.

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