Figure S1: Scaling relationship between log RMR and log relative weapon muscle mass A (muscle mass/body size; top) and log relative muscle mass B (muscle mass/body mass; bottom) for stick insects, frog-legged beetles, and stag beetles. Red lines represent OLS regression. Shaded areas represent 95% confidence intervals around OLS regressions.

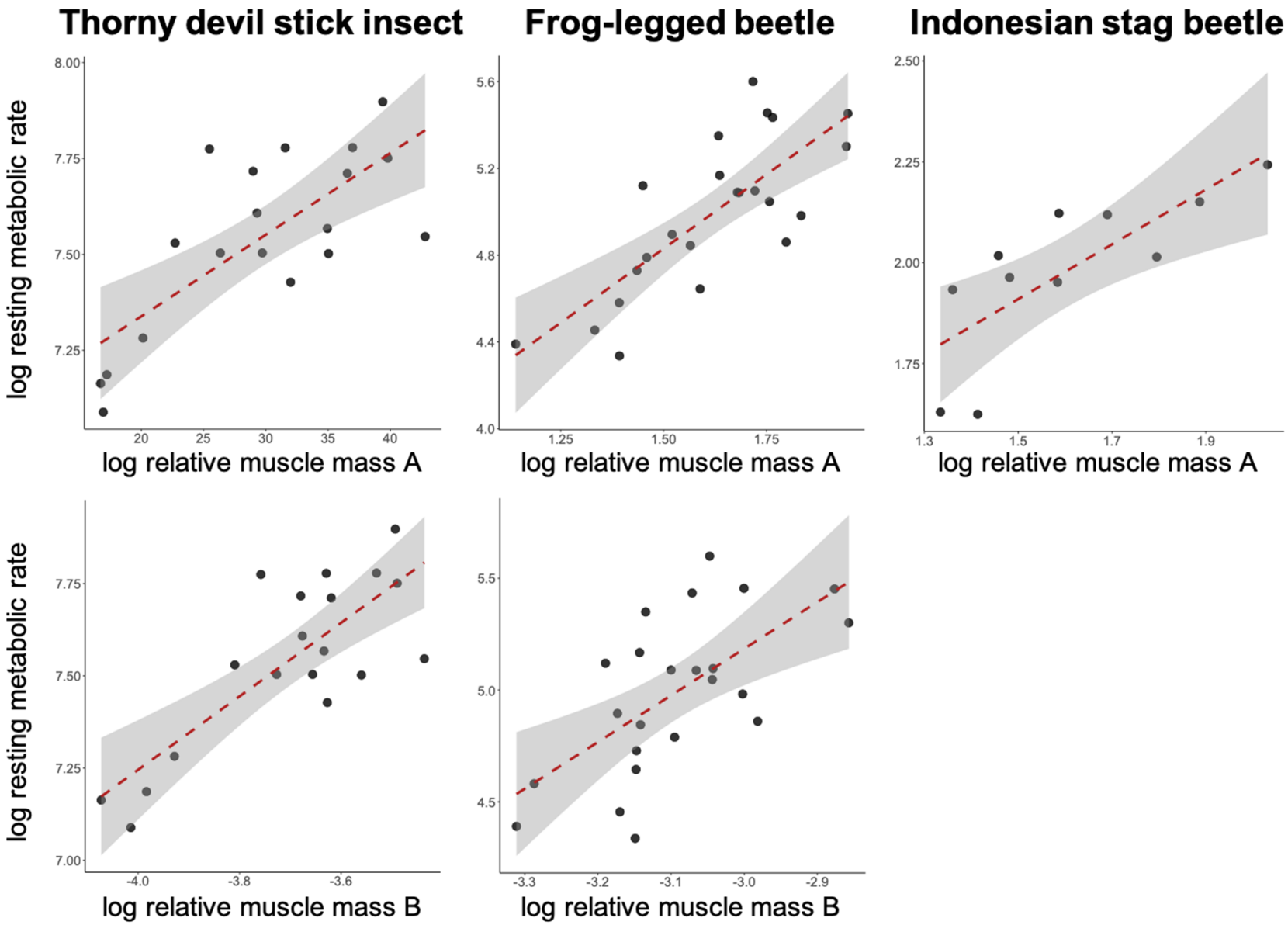

Table S1: Source and rearing data for study species. All animals were fed *ad libidum*. *New Zealand long-legged harvestmen measured shortly after capture and immediately returned to the wild.

Common name	Species	RMR measure location	Source location	Supplier	Stage collected	Rearing location	Rearing T (C)	Juvenile Food source	Adult food source
Thorny devil stick insect	*Eurycantha calcarata*	Montana, USA	West New Britan, Papua New Guinea	Missoula Insectarium	Juvenile	Montana, USA	22	Maple and raspberry leaves	Maple and raspberry leaves
NZ long-legged harvestmen	*Forsteropsalis pureora*	Waitomo, New Zealand	Waitomo, New Zealand	Wild caught	Adult	NA	NA	NA	NA*
Frog-legged leaf beetle	*Sagra femorata*	Okazaki, Japan	Matsuzaka, Japan	Wild caught	Adult	NA	NA	NA	Kudzu leaves (Pueraria spp.)
Leaf-footed cactus bug	*Narnia femorata*	Montana, USA	Florida, USA	Wild caught	Juvenile	Montana, USA	28	Cactus fruit and pads (Opuntia spp.)	Cactus fruit and pads (Opuntia sp
Indonesian stag beetle	*Cyclommatus metallifer*	Montana, USA	Nagoya, Japan	University of Nagoya (captive bred)	Adult	NA	NA	NA	Organic apples
Japanese rhinoceros beetle	*Trypoxylus dichotomus*	Montana, USA	Hamada City, Japan	Yasaka Kobuto Kuwagata World	Larvae	Montana, USA	28	Composted wood shavings	Organic apples
Heliconia bug	*Leptoscelis tricolor*	Gamboa, Panama	Gamboa, Panama	Wild caught	Adult	NA	NA	NA	Heliconia flower (*H. platystach*

Table S2: Measurements of weapon and body size included as variables in principal components analyses (rounded to the nearest hundredth), % variation explained by PC1 in weapon size or body size PCAs, and section of weapon dissected for muscle digestion for each species. Bold measures of weapon/body size were used for scaling analyses.

Common name	Weapon measures	Weapon size PC1	Body size measures	Body size PC1	Muscle mass dissection
Thorny devil stick insect	**Hindfemur area**	NA	**Mesothrax width** Body length	76.62%	Whole hindlimb
NZ long-legged harvestman	**Chela length** Chela width	65.93%	**Prosoma width**	NA	Right chela
Frog-legged leaf beetle	**Hindfemur length** Hindfemur width Hindtibia length	95%	**Prothorax width** Elytra length	97.59%	Whole hindlimb
Leaf-footed cactus bug	**Hindfemur length** Hindfemur area Hindtibia length Hindtibia area	90.31%	**Prothorax width** Body length Head length Foretibia length Forefemur length	79.56%	Whole hindlimb
Indonesian stag beetle	**Mandible length** Head width	86.28%	**Prothorax width** Elytra length Foretibia length	87.66%	Mandibles Head
Japanese rhinoceros beetle	**Head horn length** Head horn width	92.37%	**Prothorax width** Elytra length	96.38%	Head horn Head Prothorax
Heliconia bug	**Femur width**	NA	**Prothorax width**	NA	Whole hindlimb

Table S3: Summary of multiple regression models (resting metabolic rate (RMR) regressed on overall weapon size and body size (RMR~body size*weapon size) within the same model).

Common name	Parameters	β	SE	*p*	Adjusted R^2	F_{df}	*p*
Thorny devil stick insect	Body size	-0.81	1.53	0.605	0.62	$10.81_{3,15}$	< 0.001
	Weapon size	1.283	0.502	0.05			
	Body size*weapon size	0.138	0.27	0.591			
NZ long-legged harvestmen	Body size	3.1004	1.33	0.029	0.135	$2.351_{3,23}$	0.09
	Weapon size	0.826	1.29	0.53			
	Body size*weapon size	-0.971	1.094	0.384			
Frog-legged beetle	Body size	-0.089	0.128	0.494	0.651	$14.65_{3,19}$	< 0.0001
	Weapon size	0.259	0.104	0.022			
	Body size*weapon size	-0.018	0.026	0.5			
Leaf-footed cactus bug	Body size	0.175	0.149	0.248	-0.01	$0.869_{3,35}$	0.467
	Weapon size	-0.111	0.153	0.472			
	Body size*weapon size	-0.009	0.016	0.575			
Indonesian stag beetle	Body size	1.600E-04	0.031	0.999	0.778	$15.03_{3,9}$	< 0.001
	Weapon size	1.330E-01	0.037	0.006			
	Body size*weapon size	-0.024	0.012	0.079			
Japanese rhinoceros beetle	Body size	-0.427	0.321	0.207	1.00E-04	$1.001_{3,12}$	0.426
	Weapon size	0.49	0.326	0.159			
	Body size*weapon size	0.043	0.091	0.646			
Heliconia bug	Body size	0.194	4.957	0.969	0.013	$1.09_{3,18}$	0.379
	Weapon size	14.411	16.473	0.393			
	Body size*weapon size	-6.749	8.877	0.457			

Table S4: Summary of relative muscle mass A (RMM-A) and B (RMM-B) for each species. *measured as wet muscle mass. Relative muscle mass A = muscle mass/linear measurements of body size. Relative muscle mass B = muscle mass/body mass.

Common name	Mean (RMM-A)	95% CI (mean RMM-A)	Mean (RMM-B)	95% CI (mean RMM-B)
Thorny devil stick insect	29.614	[25.699, 33.528]	0.025	[0.023, 0.027]
NZ long-legged harvestmen	0.141	[0.098, 0.185]	0.006	[0.004, 0.008]
Frog-legged leaf beetle	5.124	[4.691, 5.556]	0.206	[0.186, 0.225]
Leaf-footed cactus bug	0.278	[0.247, 0.309]	2.06E-05	[1.895E-05, 2.223E-05]
Indonesian stag beetle	5.085	[4.264, 5.906]	0.035	NA
Japanese rhinoceros beetle*	77.724	[73.969, 81.479]	0.325	[0.323, 0.327]
Heliconia bug	13.774	[25.559, 1.988]	0.007	[0.013, 0.001]