Table S1. The effects of freezing temperature exposure on egg production in *Eurosta solidaginis*. Values are generalized linear model (quasipoisson distribution) statistics comparing egg production in adult *Eurosta solidaginis* as a result of cold exposure type (repeated exposures or a single exposure), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	Initial model	Minimal adequate model	Term	F	df	P
Repeated	Y = body mass + exposure temperature × period between exposures × number of exposures	Y = body mass	**Body mass**	**102.4**	**1, 148**	**<0.001**
Prolonged	Y = body mass + exposure temperature × time of year exposed	Y = body mass	**Body mass**	**41.31**	**1, 29**	**<0.001**
Repeated vs. prolonged	Y = body mass + exposure type	Y = body mass + exposure type	**Body mass** **Exposure type**	**140.4** **3.91**	**1, 178** **1, 178**	**<0.001** **0.048**

Table S2. The effects of freezing temperature exposure on survival to adulthood in *Eurosta solidaginis.* Values are generalized linear model (binomial distribution) statistics comparing survival to eclosion in *Eurosta solidaginis* as a result of cold exposure type (repeated exposures or a single exposure), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	Initial model	Minimal adequate model	Term	Df	P
Repeated	Y = exposure temperature × period between exposures × number of exposures	Y = exposure temperature + period between exposures + temperature × period	Temperature	1, 25	0.282
			Number	2, 21	0.340
			Period	2, 23	0.100
			Temperature × Period	**2, 19**	**0.019**
			Temperature × Number	**2, 17**	**<0.001**
			Number × Period	**4, 13**	**0.012**
			Temperature × Number × Period	**4, 9**	**<0.001**
Prolonged	Y = exposure temperature × time of year exposed	Y = exposure temperature × time of year exposed	Temperature	1, 3	0.808
			Time of year	1, 4	0.380
			Temperature × Time of year	**1, 2**	**0.026**
Repeated vs. prolonged	Y = exposure type × temperature	Y = exposure type + exposure temperature	**Exposure type**	**4, 10**	**<0.001**
			Exposure temperature	**1, 9**	**0.013**

Table S3. The effects of freezing temperature exposure on supercooling point (SCP) in *Eurosta solidaginis* prepupae. Values are ANOVA statistics comparing supercooling point (°C) in *Eurosta solidaginis* prepupae as a result of cold exposure type (repeated exposures, a single exposure, or control conditions at 0 ºC), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Control prepupae were sampled in January, February, and March (time of year sampled). Reported effect sizes are from a linear model with the same terms and represent total change (in °C) due to the term. Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	**Initial model**	**Minimal adequate model**	**Term**	**F**	**Df**	**P (effect size)**
Repeated	Y = exposure temperature × frequency of exposures × number of exposures	Y = exposure temperature × frequency of exposures × number of exposures	Exposure temperature	0.03	1, 553	0.86 (0.37
			Frequency of exposure	0.48	1, 553	0.49 (-0.82)
			Number of exposures	**18.14**	**1, 553**	**< 0.001 (-1.13)**
			Exposure temperature × Frequency of exposure	3.08	1, 553	0.08 (-0.06)
			Exposure temperature × Number of exposures	0.99	1, 553	0.32 (-0.07)
			Frequency of exposure × Number of exposures	0.25	1, 553	0.62 (0.15)
			Temperature × Frequency of exposures × Number of exposures	**29.12**	**1, 553**	**< 0.001 (0.01)**
Prolonged	Y = exposure temperature × time of year exposed and sampled	Y = time of year exposed and sampled	Exposure temperature	2.59	1, 171	0.121 (0.06)
			Time of year	**23.07**	**1, 171**	**<0.001 (-1.61**)
Control	Y = time of year sampled	Y = intercept				
Repeated vs. prolonged vs. control	Y = exposure temperature × exposure type	Y = exposure type	**Exposure type**	**6.59**	**1, 233**	**0.011 (-0.77)**

Table S4. The effects of freezing temperature exposure on glycogen content in *Eurosta solidaginis* prepupae. Values are ANCOVA statistics comparing glycogen mass (mg) in *Eurosta solidaginis* prepupae as a result of cold exposure type (repeated exposures, a single exposure, or control conditions at 0 ºC), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Control prepupae were sampled in January, February, and March (time of year sampled). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	Initial model	Minimal adequate model	Term	F	Df	P
Repeated	Y = protein mass + exposure temperature × period between exposures × number of exposures	Y = protein mass	**Protein**	**79.200**	**1, 133**	**<0.001**
Prolonged	Y = protein mass + exposure temperature × time of year exposed and sampled	Y = protein mass + temperature	**Protein** **Temperature**	**40.050** **6.638**	**1, 42** **1, 42**	**<0.001** **0.014**
Control	Y = protein mass + time of year sampled	Y = protein mass + time of year sampled	**Protein** **Time of year**	**7.016** **6.641**	**1, 11** **2, 11**	**0.023** **0.013**
Repeated vs. prolonged vs. control	Y = protein mass + exposure group	Y = protein mass	**Protein**	**120.89**	**1, 193**	**<0.001**

Table S5. The effects of freezing temperature exposure on glycerol content in *Eurosta solidaginis* prepupae. Values are ANCOVA statistics comparing glycerol mass (mg) in *Eurosta solidaginis* prepupae as a result of cold exposure type (repeated exposures, a single exposure, or control conditions at 0 ºC), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Control prepupae were sampled in January, February, and March (time of year sampled). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	Initial model	Minimal adequate model	Term	F	Df	P
Repeated	Y = protein mass + exposure temperature × period between exposures × number of exposures	Y = protein mass + exposure temperature × period between exposures × number of exposures	**Protein**	**6.971**	**1, 116**	**0.009**
			Temperature	1.972	1, 116	0.163
			Period	**3.385**	**2, 116**	**0.037**
			Number	**2.530**	**2, 116**	**0.048**
			Temperature × Period	**10.095**	**2, 116**	**<0.001**
			Temperature × Number	**5.752**	**2, 116**	**0.004**
			Period × Number	1.693	4, 116	0.156
			Temperature × Period × Number	**5.491**	**4, 116**	**<0.001**
Prolonged	Y = protein mass + exposure temperature × time of year exposed and sampled	Y = protein mass + exposure temperature × time of year exposed and sampled	Protein	0.272	1, 38	0.605
			Temperature	**5.700**	**1, 38**	**0.022**
			Time of year	**7.713**	**2, 38**	**0.002**
			Temperature × Time of year	2.836	2, 38	0.071
Control	Y = protein mass + time of year sampled	Y = null model				
Repeated vs. prolonged vs. control	Y = protein mass + exposure group	Y = protein mass + exposure group	Protein	0.228	1, 85	0.634
			Exposure group	**5.930**	**18, 85**	**<0.001**

Table S6. The effects of freezing temperature exposure on sorbitol content in *Eurosta solidaginis* prepupae. Values are ANCOVA statistics comparing sorbitol mass (mg) in *Eurosta solidaginis* prepupae as a result of cold exposure type (repeated exposures, a single exposure, or control conditions at 0 ºC), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Control prepupae were sampled in January, February, and March (time of year sampled). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	Initial model	Minimal adequate model	Term	F	Df	P
Repeated	Y = protein mass + exposure temperature × period between exposures × number of exposures	Y = exposure temperature × period between exposures × number of exposures	Temperature	1.224	1, 117	0.271
			Period	**21.755**	**2, 117**	**<0.001**
			Number	0.019	2, 117	0.981
			Temperature × Period	1.722	2, 117	0.183
			Temperature × Number	**5.080**	**2, 117**	**0.008**
			Period × Number	**8.571**	**4, 117**	**<0.001**
			Temperature × Period × Number	**3.443**	**4, 117**	**0.011**
Prolonged	Y = protein mass + exposure temperature × time of year exposed and sampled	Y = exposure temperature × time of year exposed and sampled	**Temperature**	**6.428**	**1, 39**	**0.015**
			Time of year	**10.651**	**2, 39**	**<0.001**
			Temperature × time of year	**8.352**	**2, 39**	**<0.001**
Control	Y = protein mass + time of year sampled	Y = time of year	**Time of year**	**4.716**	**2, 12**	**0.031**
Repeated vs. prolonged vs. control	Y = protein mass + exposure group	Y = exposure group	**Exposure group**	**8.814**	**20, 84**	**<0.001**

Table S7. The effects of freezing temperature exposure on long-chain triacylglycerol content in *Eurosta solidaginis* prepupae. Values are ANCOVA statistics comparing long chain triacylglycerol mass (mg) in *Eurosta solidaginis* prepupae as a result of cold exposure type (repeated exposures, a single exposure, or control conditions at 0 ºC), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Control prepupae were sampled in January, February, and March (time of year sampled). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure type	Initial model	Minimal adequate model	Term	F	Df	P
Repeated	Y = total lipid mass + exposure temperature × period between exposures × number of exposures	Y = total lipid mass + temperature + number of exposures	**Total lipid mass**	**2287.28**	**1, 13**	**< 0.001**
			Temperature	**4.57**	**1, 130**	**0.0344**
			Number	2.98	2, 130	0.054
Prolonged	Y = total lipid mass + exposure temperature × time of year exposed and sampled	Y = total lipid mass + temperature × time of year	**Total lipid mass**	**643.40**	**1, 38**	**<0.001**
			Temperature	1.04	1, 38	0.315
			Time of year	1.16	2, 38	0.324
			Temp × time of year	**3.79**	**2, 38**	**0.032**
Control	Y = total lipid mass + time of year sampled	Y = total lipid mass	**Total lipid mass**	**242.50**	**1, 13**	**<0.001**
Repeated vs. prolonged vs. control	Y = total lipid mass + exposure group	Y = total lipid mass + exposure group	**Total lipid content**	**1189.46**	**1, 91**	**<0.001**
			Exposure group	**2.78**	**12, 91**	**0.003**

Table S8. The effects of freezing temperature exposure on acetylated triacylglycerol content in *Eurosta solidaginis* prepupae. Values are ANCOVA statistics comparing acetylated triacylglycerol mass (mg) in *Eurosta solidaginis* prepupae as a result of cold exposure type (repeated exposures, a single exposure, or control conditions at 0 ºC), at different temperatures (-10, -15, or -20 °C) as overwintering prepupae. Repeatedly-exposed prepupae received 3, 6, or 10 freezing events of 12 h duration (number of exposures), at a time interval of 1, 5, or 10 days (period between exposures), while prolonged freeze prepupae received a single 120 h freezing exposure either in January or in March (time of year exposed). Control prepupae were sampled in January, February, and March (time of year sampled). Retained terms with significant p-values ($p < 0.05$) are in bold typeface.

Exposure e type	Initial model	Minimal adequate model	Term	F	Df	P
Repeated	Y = total lipid mass + exposure temperature × period between exposures × number of exposures	Y = total lipid mass + exposure temperature	**Total lipid mass** **Temperature**	**2287.28** **6.10**	**1, 132** **1, 132**	**< 0.001** **0.0148**
Prolonged	Y = total lipid mass + exposure temperature × time of year exposed and sampled	Y = total lipid mass	**Total lipid mass**	**768.90**	**1, 43**	**<0.001**
Control	Y = total lipid mass + time of year sampled	Y = total lipid mass	**Total lipid mass**	**242.50**	**1, 13**	**<0.001**
Repeated vs. prolonged vs. control	Y = total lipid mass + exposure group	Y = total lipid mass + exposure group	**Total lipid content** **Exposure group**	**2132.58** **5.90**	**1, 144** **4, 144**	**<0.001** **<0.001**