



Figure S1. Water temperature in Lake Mývatn at the cold (blue) and warm (red) sampling site from 20/06/14 to 19/06/15.

Table S1. Linear models (LMs) on host and parasite body condition parameters and host immunity. Simple comparisons for all interpretable interactions (I1 - I13) can be found in Table S2. *Symbols:* ‘-’; not included into the model, ‘n. s.’; not significant ($P > 0.050$), ‘(...)’, not interpretable because of a significant higher level interaction effect.

	models include all uninfected sticklebacks (sham-exposed and exposed but not infected)				model includes all parasite exposed sticklebacks (exposed but not infected and infected)				parasite weight
	host length increase	host gonad weight	number of viable HKLs	respiratory burst activity	host length increase	host gonad weight	number of viable HKLs	respiratory burst activity	
experimental temperature	$F_{1,162} = 158.12, P < 0.001$	$F_{1,162} = 66.31, P < 0.001$	($F_{1,162} = 23.48, P < 0.001$)	$F_{1,143} = 34.62, P < 0.001$	$F_{1,282} = 265.50, P < 0.001$	$F_{1,282} = 169.56, P < 0.001$	($F_{1,282} = 140.65, P < 0.001$)	$F_{1,252} = 51.31, P < 0.001$	$F_{1,188} = 266.95, P < 0.001$
host gender	($F_{1,162} = 4.82, P = 0.030$)	$F_{1,162} = 75.30, P < 0.001$	n. s.	($F_{1,143} = 5.14, P = 0.025$)	$F_{1,282} = 7.68, P = 0.006$	$F_{1,282} = 206.63, P < 0.001$	n. s.	($F_{1,252} = 9.54, P = 0.002$)	$F_{1,188} = 7.08, P = 0.008$
host infection status	n. s.	n. s.	n. s.	n. s.	$F_{1,282} = 51.43, P < 0.001$	n. s.	($F_{1,282} = 43.38, P < 0.001$)	$F_{1,252} = 51.87, P < 0.001$	-
host origin	n. s.	n. s.	($F_{1,162} = 5.77, P = 0.017$)	n. s.	($F_{1,282} = 11.55, P = 0.001$)	n. s.	n. s.	n. s.	n. s.
parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
experimental temperature × host gender	I1: $F_{1,162} = 5.25, P = 0.023$	n. s.	I2: $F_{1,162} = 8.90, P = 0.003$	I5: $F_{1,143} = 5.93, P = 0.016$	n. s.	I7: $F_{1,282} = 9.53, P = 0.002$	($F_{1,282} = 6.11, P = 0.014$)	I12: $F_{1,252} = 5.33, P = 0.022$	n. s.
experimental temperature × host infection status	n. s.	n. s.	I3: $F_{1,162} = 7.86, P = 0.006$	n. s.	n. s.	n. s.	($F_{1,282} = 10.36, P = 0.001$)	n. s.	-
experimental temperature × host origin	n. s.	n. s.	I4: $F_{1,162} = 4.04, P = 0.046$	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.
experimental temperature × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
host gender × host infection status	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	-
host gender × host origin	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.
host gender × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
host infection status × host origin	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	I10: $F_{1,282} = 14.32, P < 0.001$	n. s.	-
host infection status × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	-
host origin × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
experimental temperature × host gender × host infection status	n. s.	n. s.	n. s.	n. s.	n. s.	I8: $F_{1,282} = 9.953, P = 0.002$	I11: $F_{1,282} = 4.740, P = 0.030$	n. s.	-
experimental temperature × host gender × host origin	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.
experimental temperature × host gender × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
experimental temperature × host infection status × host origin	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	-
experimental temperature × host infection status × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	-
experimental temperature × host origin × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
host gender × host infection status × host origin	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	n. s.	I13: $F_{1,252} = 4.06, P = 0.045$	-
host gender × host infection status × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	-
host gender × host origin × parasite origin	-	-	-	-	n. s.	n. s.	n. s.	n. s.	n. s.
host infection status × host origin × parasite origin	-	-	-	-	I6: $F_{1,282} = 5.40, P = 0.021$	I9: $F_{1,282} = 4.25, P = 0.040$	n. s.	n. s.	-

Table S2. Simple comparisons for significant, interpretable interactions (see Table S1 for an overview of all significant effects). *Symbols:* 'n. s.', not significant ($P > 0.050$).

interaction (see table S1)	1st interaction effect	2nd interaction effect	3rd interaction effect	P-value	interaction (see table S1)	1st interaction effect	2nd interaction effect	3rd interaction effect	P-value
I1 model on host length increase exp. temperature × host gender $F_{1,162} = 5.25, P = 0.023$	exp. temperature	host gender	-						
	13 °C	male vs. female		n. s.					
	24 °C	male vs. female		0.002					
	host gender	exp. temperature	-						
male	13 °C vs. 24 °C		< 0.001						
female	13 °C vs. 24 °C		< 0.001						
I2 model on number of viable HKLs exp. temperature × host gender $F_{1,162} = 8.90, P = 0.003$	exp. temperature	host gender	-						
	13 °C	male vs. female		0.043					
	24 °C	male vs. female		0.038					
	host gender	exp. temperature	-						
male	13 °C vs. 24 °C		< 0.001						
female	13 °C vs. 24 °C		n. s.						
I3 model on number of viable HKLs exp. temperature × host infection status $F_{1,162} = 7.86, P = 0.006$	exp. temperature	host infection status	-						
	13 °C	sham vs. exposed		0.014					
	24 °C	sham vs. exposed		n. s.					
	host infection status	exp. temperature	-						
sham	13 °C vs. 24 °C		n. s.						
exposed	13 °C vs. 24 °C		< 0.001						
I4 model on number of viable HKLs exp. temperature × host origin $F_{1,162} = 4.04, P = 0.046$	exp. temperature	host origin	-						
	13 °C	cold vs. warm		n. s.					
	24 °C	cold vs. warm		0.002					
	host origin	exp. temperature	-						
cold	13 °C vs. 24 °C		< 0.001						
warm	13 °C vs. 24 °C		0.045						
I5 model on respiratory burst activity exp. temperature × host gender $F_{1,143} = 5.93, P = 0.016$	exp. temperature	host gender	-						
	13 °C	male vs. female		< 0.001					
	24 °C	male vs. female		n. s.					
	host gender	exp. temperature	-						
male	13 °C vs. 24 °C		0.023						
female	13 °C vs. 24 °C		< 0.001						
I6 model on host length increase host infection status × host origin × parasite origin $F_{1,282} = 5.40, P = 0.021$	host infection status	host origin	parasite origin						
	exposed	cold	cold vs. warm	n. s.					
	exposed	warm	cold vs. warm	n. s.					
	infected	cold	cold vs. warm	n. s.					
	infected	warm	cold vs. warm	n. s.					
	host infection status	parasite origin	host origin						
	exposed	cold	cold vs. warm	n. s.					
	exposed	warm	cold vs. warm	0.020					
	infected	cold	cold vs. warm	0.001					
	infected	warm	cold vs. warm	n. s.					
	host origin	parasite origin	host infection status						
	cold	cold	exposed vs. infected	0.014					
cold	warm	exposed vs. infected	< 0.001						
warm	cold	exposed vs. infected	< 0.001						
warm	warm	exposed vs. infected	0.020						
I7 model on host gonad weight exp. temperature × host gender $F_{1,282} = 9.53, P = 0.002$	exp. temperature	host gender	-						
	13 °C	male vs. female		< 0.001					
	24 °C	male vs. female		< 0.001					
	host gender	exp. temperature	-						
	male	13 °C vs. 24 °C		< 0.001					
	female	13 °C vs. 24 °C		< 0.001					
	I8 model on host gonad weight exp. temperature × host gender × host infection status $F_{1,282} = 9.95, P = 0.002$	exp. temperature	host gender	host infection status					
		13 °C	male	exposed vs. infected	n. s.				
		13 °C	female	exposed vs. infected	0.008				
		24 °C	male	exposed vs. infected	n. s.				
		24 °C	female	exposed vs. infected	0.016				
		exp. temperature	host infection status	host gender					
13 °C		exposed	male vs. female	< 0.001					
13 °C		infected	male vs. female	< 0.001					
24 °C		exposed	male vs. female	< 0.001					
24 °C		infected	male vs. female	< 0.001					
host gender		host infection status	exp. temperature						
male		exposed	13 °C vs 24 °C	< 0.001					
female	infected	13 °C vs 24 °C	< 0.001						
female	exposed	13 °C vs 24 °C	< 0.001						
female	infected	13 °C vs 24 °C	< 0.001						
I9 model on host gonad weight host infection status × host origin × parasite origin $F_{1,282} = 4.25, P = 0.040$	host infection status	host origin	parasite origin						
	exposed	cold	cold vs. warm	n. s.					
	exposed	warm	cold vs. warm	n. s.					
	infected	cold	cold vs. warm	n. s.					
	infected	warm	cold vs. warm	n. s.					
	host infection status	parasite origin	host origin						
	exposed	cold	cold vs. warm	n. s.					
	exposed	warm	cold vs. warm	n. s.					
	infected	cold	cold vs. warm	0.047					
	infected	warm	cold vs. warm	n. s.					
	host origin	parasite origin	host infection status						
	cold	cold	exposed vs. infected	0.022					
cold	warm	exposed vs. infected	n. s.						
warm	cold	exposed vs. infected	n. s.						
warm	warm	exposed vs. infected	n. s.						
I10 model on number of viable HKLs host infection status × host origin $F_{1,282} = 14.32, P < 0.001$	host infection status	host origin	-						
	exposed	cold vs. warm		0.001					
	infected	cold vs. warm		n. s.					
	host origin	host infection status	-						
cold	exposed vs. infected		< 0.001						
warm	exposed vs. infected		0.050						

Interaction (see table S1)	1st interaction effect	2nd interaction effect	3rd interaction effect	P-value
I11 model on number of viable HKLs exp. temperature × host gender × host infection status $F_{1,282} = 4.74, P = 0.030$	exp. temperature	host gender	host infection status	
	13 °C	male	exposed vs. infected	< 0.001
	13 °C	female	exposed vs. infected	< 0.001
	24 °C	male	exposed vs. infected	0.005
	24 °C	female	exposed vs. infected	n. s.
	exp. temperature	host infection status	host gender	
	13 °C	exposed	male vs. female	0.020
	13 °C	infected	male vs. female	n. s.
	24 °C	exposed	male vs. female	n. s.
	24 °C	infected	male vs. female	n. s.
	host gender	host infection status	exp. temperature	
	male	exposed	13 °C vs 24 °C	< 0.001
	male	infected	13 °C vs 24 °C	< 0.001
female	exposed	13 °C vs 24 °C	n. s.	
female	infected	13 °C vs 24 °C	< 0.001	
I12 model on respiratory burst activity exp. temperature × host gender $F_{1,252} = 5.33, P = 0,022$	exp. temperature	host gender	-	
	13 °C	male vs. female		< 0.001
	24 °C	male vs. female		n. s.
	host gender	exp. temperature	-	
	male	13 °C vs. 24 °C		0.002
	female	13 °C vs. 24 °C		< 0.001
I13 model on respiratory burst activity host gender × host infection status × host origin $F_{1,252} = 4.06, P = 0.045$	host gender	host infection status	host origin	
	male	exposed	cold vs. warm	n. s.
	male	infected	cold vs. warm	n. s.
	female	exposed	cold vs. warm	0.008
	female	infected	cold vs. warm	n. s.
	host gender	host origin	host infection status	
	male	cold	exposed vs. infected	< 0.001
	male	warm	exposed vs. infected	0.001
	female	cold	exposed vs. infected	0.034
	female	warm	exposed vs. infected	< 0.001
	host infection status	host origin	host gender	
	exposed	cold	male vs. female	0.001
	exposed	warm	male vs. female	n. s.
infected	cold	male vs. female	n. s.	
infected	warm	male vs. female	n. s.	

Table S3. Linear models (LMs) on host tolerance. *Symbols:* ‘-’, not included into the model; ‘n. s.’, not significant ($P > 0.050$).

	including host/parasite origins		including sympatry/allopatry	
	host health tolerance	host fecundity tolerance	host health tolerance	host fecundity tolerance
experimental temperature	$F_{1,177} = 25.35, P < 0.001$	$F_{1,177} = 10.71, P = 0.001$	$F_{1,188} = 21.09, P < 0.001$	$F_{1,188} = 10.19, P = 0.002$
host gender	n. s.	$F_{1,177} = 18.92, P < 0.001$	$F_{1,188} = 4.11, P = 0.044$	$F_{1,188} = 29.70, P < 0.001$
host origin	n. s.	n. s.	-	-
parasite origin	n. s.	n. s.	-	-
parasite weight	n. s.	n. s.	n. s.	n. s.
sympatry/allopatry	-	-	n. s.	n. s.
experimental temperature × host gender	n. s.	n. s.	n. s.	n. s.
experimental temperature × host origin	n. s.	n. s.	-	-
experimental temperature × parasite origin	$F_{1,177} = 5.97, P = 0.015$	n. s.	-	-
experimental temperature × parasite weight	n. s.	n. s.	n. s.	n. s.
experimental temperature × sympatry/allopatry	-	-	n. s.	n. s.
host gender × host origin	n. s.	n. s.	-	-
host gender × parasite origin	n. s.	n. s.	-	-
host gender × parasite weight	n. s.	n. s.	n. s.	n. s.
host gender × sympatry/allopatry	-	-	n. s.	n. s.
host origin × parasite origin	n. s.	n. s.	-	-
host origin × parasite weight	n. s.	n. s.	-	-
parasite origin × parasite weight	n. s.	n. s.	-	-
parasite weight × sympatry/allopatry	-	-	n. s.	n. s.
experimental temperature × host gender × host origin	n. s.	n. s.	-	-
experimental temperature × host gender × parasite origin	n. s.	n. s.	-	-
experimental temperature × host gender × parasite weight	n. s.	n. s.	n. s.	n. s.
experimental temperature × host gender × sympatry/allopatry	-	-	n. s.	n. s.
experimental temperature × host origin × parasite origin	n. s.	n. s.	-	-
experimental temperature × host origin × parasite weight	n. s.	n. s.	-	-
experimental temperature × parasite origin × parasite weight	$F_{1,177} = 6.72, P = 0.010$	n. s.	-	-
experimental temperature × parasite weight × sympatry/allopatry	-	-	n. s.	n. s.
host gender × host origin × parasite origin	n. s.	n. s.	-	-
host gender × host origin × parasite weight	n. s.	n. s.	-	-
host gender × parasite origin × parasite weight	n. s.	n. s.	-	-
host gender × parasite weight × sympatry/allopatry	-	-	n. s.	n. s.
host origin × parasite origin × parasite weight	n. s.	n. s.	-	-

Table S4. Technical reasons for excluding 11 sticklebacks from data analysis.

count	technical reason
2	stickleback infected with two <i>S. solidus</i> plerocercoids
1	stickleback with deformed tail
2	gender of the stickleback could not be determined
1	kidney was extremely swollen
3	stickleback disappeared
1	stickleback did not eat the copepod
1	sham exposed stickleback was <i>S. solidus</i> infected

Table S5. Distribution of dead sticklebacks over experimental treatments. 'Count' gives the number of dead sticklebacks in the order males/females/unknown gender. Symbols: '?', host infection status unknown.

Experimental temperature (°C)	host infection status	host origin	parasite origin	count
18	sham exposed	cold	-	-/-/5
18	sham exposed	warm	-	-/-/6
18	?	cold	cold	-/-/1
18	?	cold	warm	-/-/1
18	?	warm	cold	-/-/2
18	?	warm	warm	-/-/1
13	sham exposed	cold	-	-/1/-
13	infected	cold	warm	-/-/1
24	exposed but not infected	warm	cold	1/-/-
24	sham exposed	cold	-	-/-/1
24	sham exposed	warm	-	-/-/1
24	exposed but not infected	cold	cold	-/1/-
24	exposed but not infected	warm	cold	2/-/1
24	exposed but not infected	warm	warm	-/-/1
24	infected	cold	cold	1/1/2
24	infected	warm	cold	2/2/-
24	infected	warm	warm	2/1/1
24	?	warm	warm	-/-/1