**Table S1:** Mean temperatures to which infected and uninfected *Paramecium* populations were assigned in constant and variable temperature treatments. Ticks indicate the presence, and dashes the absence, of replicate populations in constant and variable treatments assigned to that temperature. The amount of time spent at 35ºC for each of the variable treatments is indicated in brackets.

| | 23ºC | 26ºC | 28ºC | 30ºC | 32ºC | 35ºC |
|---|---|---|---|---|---|---|
| **Constant** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Variable** | - | ✓ (23 % of time at 35ºC) | ✓ (43 % of time at 35ºC) | ✓ (57 % of time at 35ºC) | ✓ (67 % of time at 35ºC) | - |

**Table S2:** Effect of *Paramecium* host clone, parasite infection, temperature, constant versus variable environment and time on a) log10 *Paramecium* population size, b) parasite prevalence. Replicate tube and block were included in models as random variables. Maximum models only included 3-way interactions as higher order interaction were not reasonably deemed interpretable. Tube and block each described less than 1% of the variation for *Paramecium* population size. Tube explained 3.64% and block 3.89% of the variation for parasite prevalence. Statistics shown represent values taken from minimal models. P-values shown correspond to * = <0.05, ** = <0.01 and *** = <0.0001.

| | | **Paramecium population size** | | | **Parasite prevalence** | | |
|---|---|---|---|---|---|---|---|
| | Numerator df | Denominator df | F-ratio | P-value | Denominator df | F-ratio | P-value |
| Clone | 1 | 136.5 | 7.38 | ** | 70.9 | 86.38 | *** |
| Parasite | 1 | 136.5 | 641.85 | *** | - | - | - |
| Variable | 1 | 137.1 | 353.49 | *** | 72.82 | 85.55 | *** |
| Temperature | 3 | 136.6 | 140.45 | *** | 71.06 | 24.86 | *** |
| Clone*Parasite | 1 | 136.5 | 65.06 | *** | - | - | - |
| Clone*Temperature | 3 | 136.6 | 7.64 | *** | 67.67 | 20.00 | *** |
| Parasite*Temperature | 3 | 136.6 | 2.87 | * | - | - | - |
| Variable*Clone | 1 | 136.8 | 44.29 | *** | 70.23 | 23.12 | *** |
| Variable*Parasite | 1 | | | | - | - | - |
| Variable*temperature | 3 | 136.8 | 5.67 | ** | 70.52 | 10.65 | *** |
| Clone*Parasite*Temperature | 1 | | | | - | - | - |
| Time | 8 | 1154 | 560.51 | *** | 502.5 | 48.23 | *** |
| Clone*Time | 8 | 1154 | 3.47 | ** | 501.5 | 49.28 | *** |
| Parasite*Time | 8 | 1154 | 6.14 | *** | - | - | - |
| Variable*Time | 8 | 1154 | 36.34 | *** | 502 | 10.18 | *** |
| Temperature*Time | 24 | 1154 | 7.92 | *** | 501.5 | 3.92 | *** |
| Clone*Parasite*Time | 8 | 1154 | 4.36 | *** | - | - | - |
| Clone*Temperature*Time | 24 | 1154 | 3.72 | *** | 500.1 | 3.91 | *** |
| Parasite*Temperature*Time | 24 | 1154 | 1.65 | * | - | - | - |
| Clone*Variable*Time | 8 | 1154 | 7.05 | *** | 500.9 | 5.79 | *** |
| Variable*Temperature*Time | 24 | | | | 501.2 | 3.26 | *** |

**Table S3:** Effect of *Paramecium* host clone, parasite infection, temperature, constant versus variable environment on a) log10 Paramecium population size, b) *Paramecium* population constancy and c) the proportion of times *Paramecium* populations were observed extinct. Temperature was included in these models as a continuous variable. Statistics shown represent values taken from minimal models. P-values shown correspond to * = <0.05, ** = <0.01 and *** = <0.0001. Boxes highlighted in grey indicate where different results are obtained if temperature is defined as a continuous variable.

| | | Host population size | | | Coefficient of variation | | | Host extinction | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Numerator df | Denominator df | F-ratio | P-value | Denominator df | F-ratio | P-value | Denominator df | F-ratio | P-value |
| Clone | 1 | 147 | 14.22 | ** | | | | 71 | 4.64 | * |
| Parasite | 1 | 147 | 584.55 | *** | 146 | 26.35 | *** | 71 | 7.12 | ** |
| Variable | 1 | 147 | 88.43 | *** | 146 | 98.56 | *** | | | |
| Temperature | 1 | 147 | 309.98 | *** | 146 | 77.60 | *** | 71 | 15.69 | ** |
| Clone*Parasite | 1 | 147 | 71.08 | *** | 146 | 10.22 | ** | | | |
| Clone*Temperature | 1 | 147 | 5.42 | * | 146 | 21.46 | *** | | | |
| Parasite*Temperature | 1 | 147 | 9.37 | ** | 146 | 7.06 | ** | 71 | 6.42 | * |
| Variable*Clone | 1 | 147 | 26.15 | *** | 146 | 22.92 | *** | | | |
| Variable*Parasite | 1 | | | | | | | | | |
| Variable*temperature | 1 | 147 | 9.07 | ** | 146 | 5.71 | * | | | |
| Clone*Parasite*Temperature | 1 | | | | 146 | 12.03 | ** | | | |
| Temperature$^2$ | 1 | 147 | | ** | | | | 71 | 9.03 | ** |

**Table S4:** Effect of *Paramecium* host clone, parasite infection, temperature, constant versus variable environment on a) parasite prevalence, and b) the proportion of times the parasite was observed extinct. Temperature was included in these models as a continuous variable. Block described 10.14 % of the variance in the model describing parasite prevalence. Statistics shown represent values taken from minimal models. P-values shown correspond to * = <0.05, ** = <0.01 and *** = <0.0001.

| | | Parasite prevalence | | | Parasite extinction | | |
|---|---|---|---|---|---|---|---|
| | Numerator df | Denominator df | F-ratio | p-value | Denominator df | F-ratio | p-value |
| Clone | 1 | 69.04 | 202.07 | *** | 71 | 4.19 | * |
| Variable | 1 | 69.02 | 45.78 | *** | 71 | 24.24 | *** |
| Temperature | 1 | 69.03 | 61.35 | *** | 71 | 12.21 | ** |
| Clone*Temperature | 1 | 69.15 | 23.66 | *** | | | |
| Variable*Clone | 1 | 69 | 17.92 | *** | | | |
| Variable*temperature | 1 | 69.17 | 7.61 | ** | 71 | 6.79 | * |
| $Temperature^2$ | 1 | 69 | 9.02 | ** | | | |
| $Temperature^2$*Clone | 1 | | | | 71 | 11.05 | ** |

**Figure S1:** Mean *Paramecium* density (solid squares, left y-axis) for a population at 30ºC in relation to temperature change between 23ºC and 35ºC (diamonds joined by solid line, right y-axis) during the experiment.

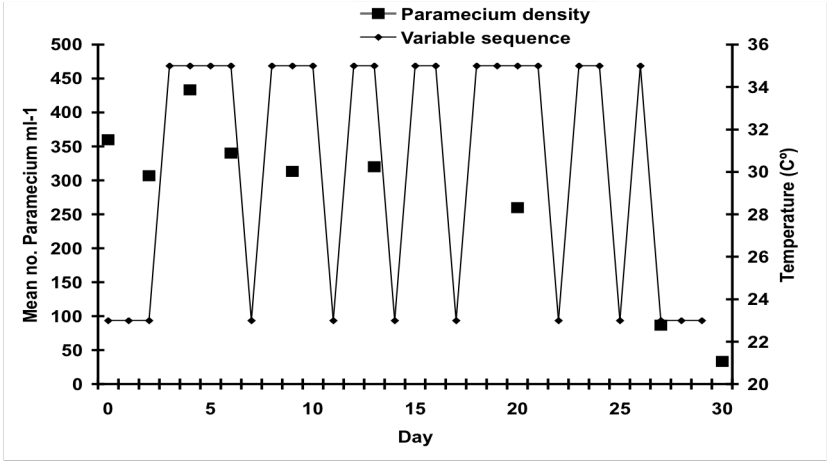


**Figure S2:** Log 10 mean *Paramecium* population size during the experiment for infected (closed symbols) and uninfected (open symbols) populations at 23ºC and 35ºC (± standard errors).

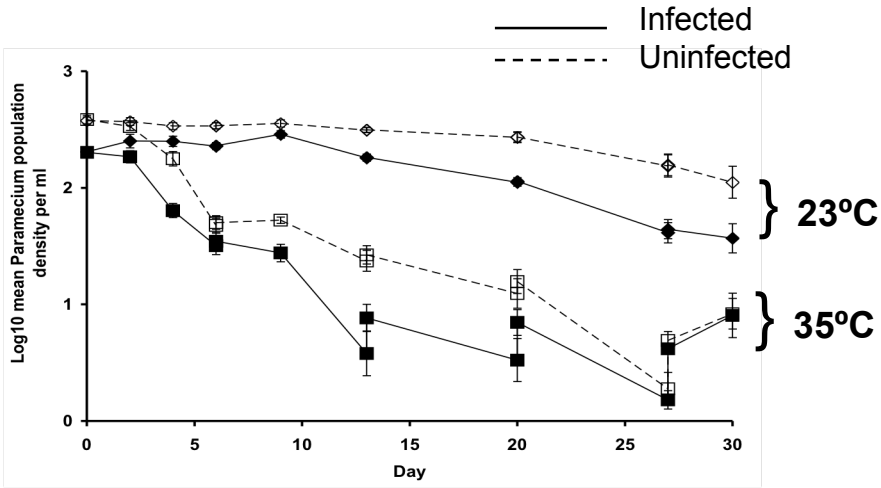
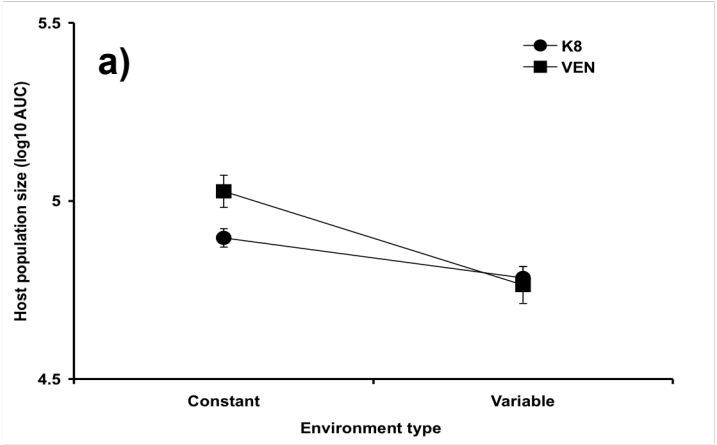
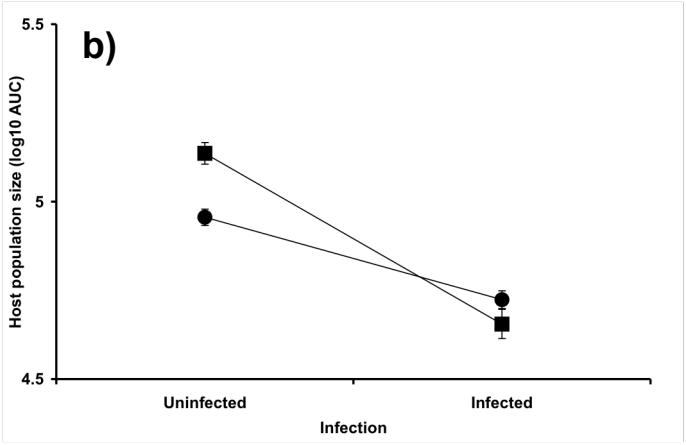


**Figure S3:** Interaction plots for host population size through time (± standard errors) for *Paramecium* host clone with a) constant versus variable environment, b) parasite infection and c) temperature. Host clone VEN = squares and host clone K8 = circles.



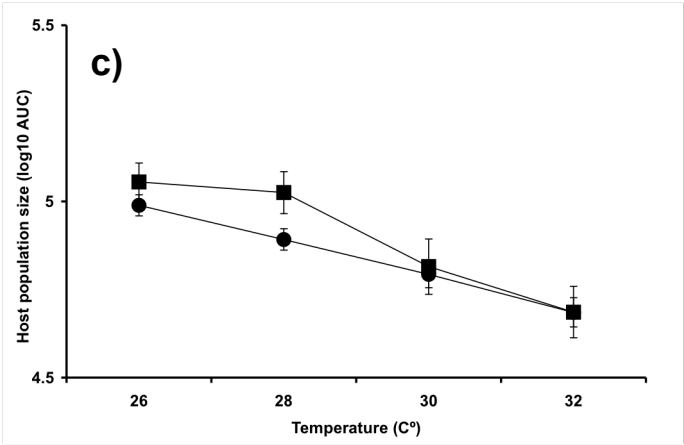



**Figure S4:** Log10 mean population densities population size for a) uninfected populations in a constant environment, b) uninfected populations in a variable environment, c) infected populations in a constant environment and d) infected populations in a variable environment. Solid lines (± standard errors) represent mean population size across temperatures and dashed lines correspond to mean for each temperature.

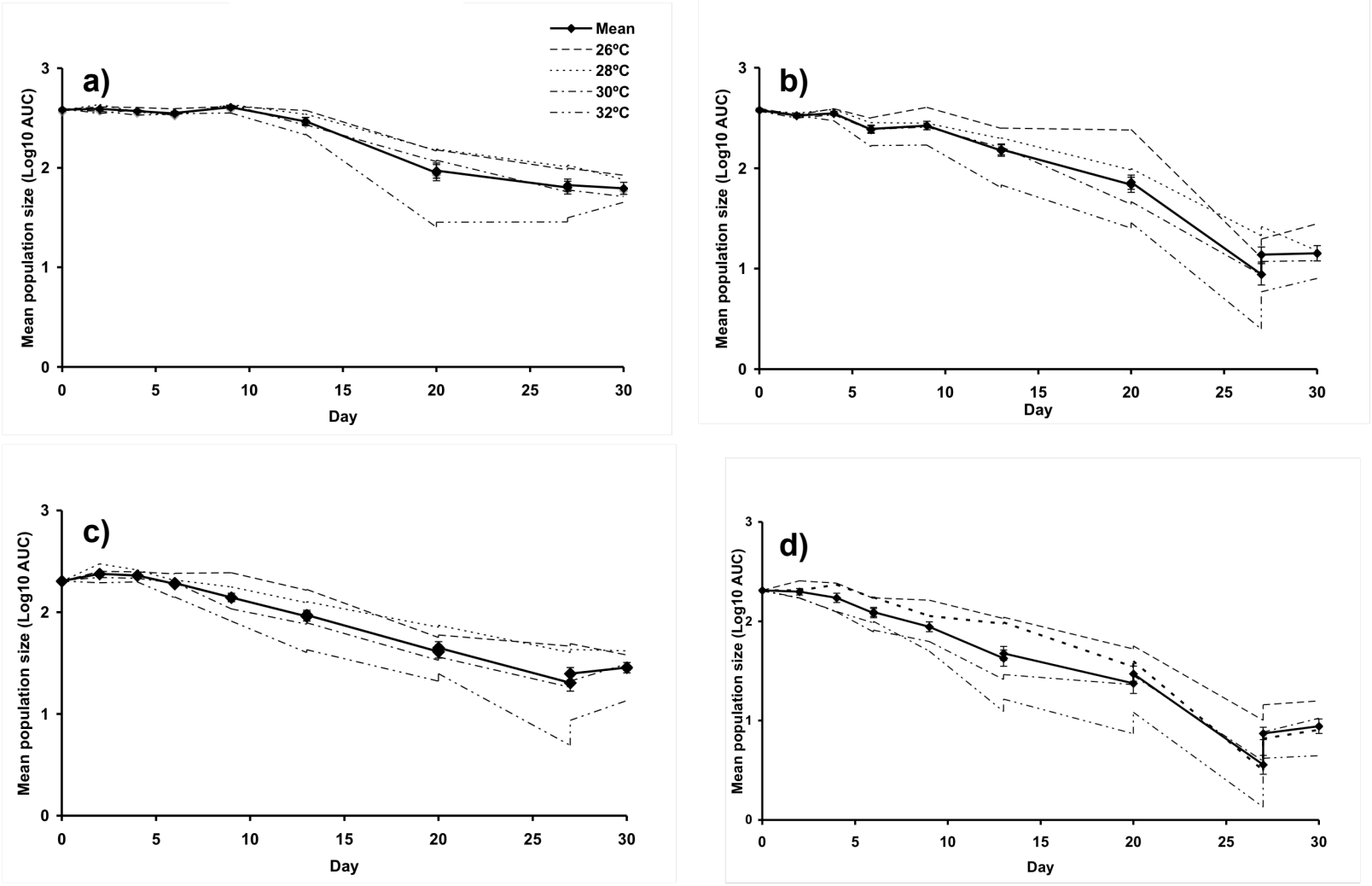


**Figure S5:** Mean parasite prevalence during the experiment in a) populations in a constant environment, and b) populations in a variable environment. Solid lines (± standard errors) represent mean prevalence across temperatures and dashed lines correspond to means for each temperature.

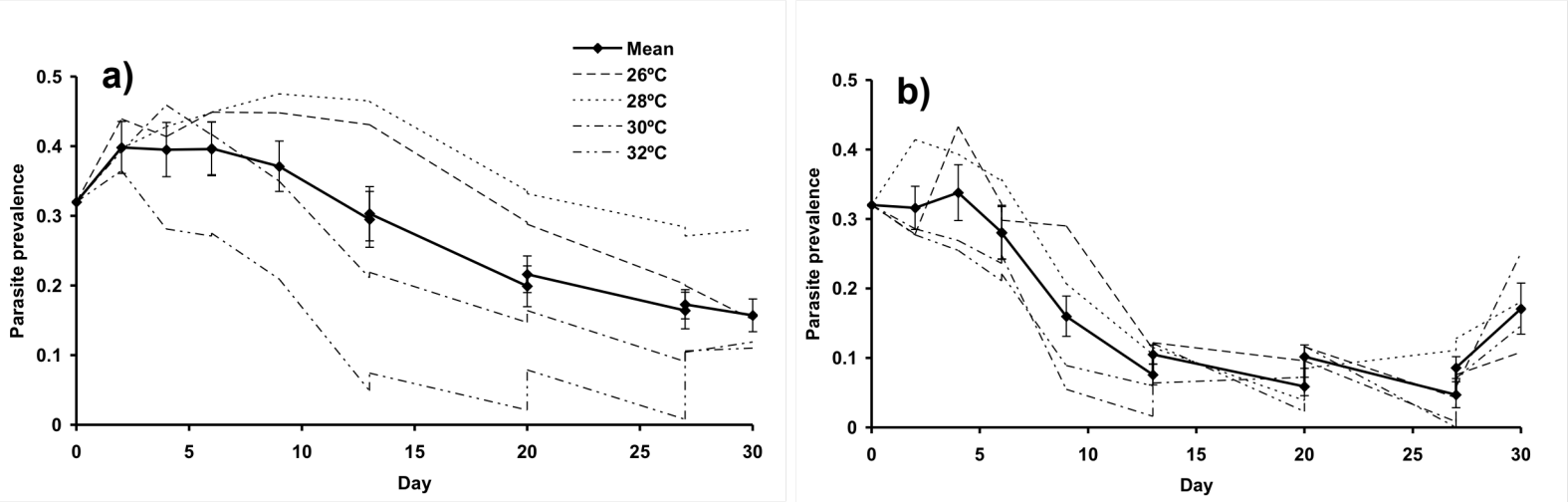


**Figure S6:** Interaction plots for parasite prevalence through time (± standard errors) for *Paramecium* host clone K8 (circles) and VEN (squares) in a) constant versus variable environment and b) at different temperatures.

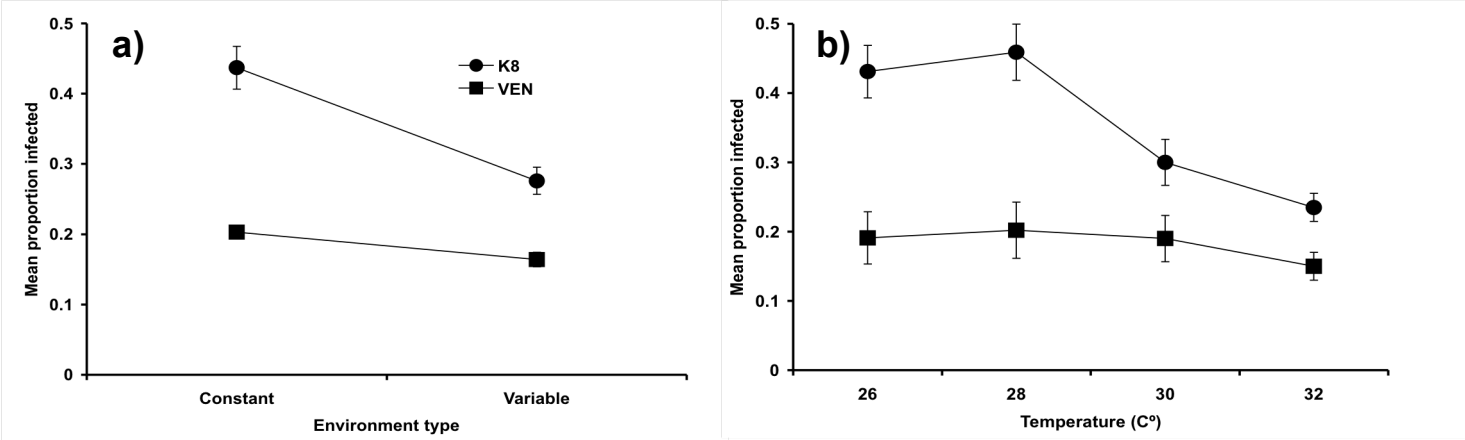


**Figure S7:** Force of infection measured as the mean proportion of uninfected *Paramecium* harbouring new infections in a) constant and b) variable environments (± standard errors).