Higher temperatures reduce the number of *Trypanosoma cruzi* parasites in the vector *Triatoma pallidipennis*

Berenice González-Rete[1], Paz Maria Salazar-Schettino[1], Martha Bucio-Torres[1], Margarita Cabrera-Bravo[1], Elia Torres-Gutierrez[1], Mariana De Alba-Alvarado[1], Olivia Reynoso-Ducoing[1], Yolanda Guevara-Gomez[1], Laura Flores-Villegas[1], Mauro Vences-Blanco[1].

[1]Universidad Nacional Autónoma de México, Facultad de Medicina, Departamento de Microbiología y Parasitología, México, México.

e-mail: bere.gonzalez.ciencias@gmail.com

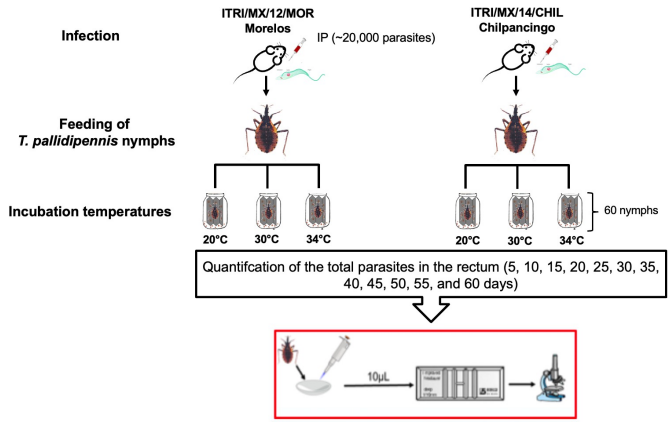
Palabras clave: triatomine, strains, global warming

Introduction

Relatively little is known about how pathogens transmitted by vector insects are affected by changing temperatures analogous to those occurring in the present global warming scenario. One expectation is that, like their ectothermic vectors, an increase in temperature could reduce their fitness. Here, we have investigated the effect of high temperatures on the abundance of *Trypanosoma cruzi* parasites during infection in the vector *Triatoma pallidipennis.*

Methods

We subjected the Chagasic bug *Triatoma pallidipennis* to two strains of the parasite *Trypanosoma cruzi*, Morelos and Chilpancingo. Previous studies have indicated that these strains differentially affect the fitness of *Triatoma pallidipennis*. Once infected, the fifth instar bed bugs were distributed into three groups with different temperatures, 20, 30 and 34° C, and the resulting parasites were counted when the bed bugs reached the adult stage.



Results

The model indicated that there were significant differences depending on the parasite strain (Morelos and Chilpancingo), temperature (20 °C, 30 °C, and 34 °C), and incubation time (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 days (Table 1).

Table 1 Results of the univariate general linear model of the total number of *Trypanosoma cruzi* parasites (Chilpancingo or Morelos strains) in the rectum of *Triatoma pallidipennis,* according to the infection status, temperature (20, 30, and 34 °C), and incubation time (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 days), and their interactions

Terms	Type III sum of squares	*df*	Mean square	*F*	*P*
Corrected model	44,813,532,638.889	71	631,176,516.041	205.725	0.0001
Intercept	116,874,117,361.113	1	116,874,117,361.113	38,093.873	0.0001
Infection status	3,171,367,361.111	1	3,171,367,361.111	1033.673	0.0001
Temperature	13,002,218,055.556	2	6,501,109,027.778	2118.967	0.0001
Incubation time	11,068,524,305.556	11	1,006,229,482.323	327.970	0.0001
Status * temperature	324,009,722.222	2	162,004,861.111	52.804	0.0001
Status * time	161,007,638.889	11	14,637,058.081	4.771	0.0001
Temperature * time	16,898,365,277.778	22	768,107,512.626	250.356	0.0001
Status * temperature * time	188,040,277.778	22	8,547,285.354	2.786	0.0001
Error	883,600,000.000	288	0.355		
Total	162,571,250,000.000	360			
Adjusted total	45,697,132,638.889	359			

P values of each corresponding *F* value indicate whether each predictor is statistically significant

These results indicate that as the temperature increased (20 °C to 30 °C), the number of parasites from the Morelos and Chilpancingo strains increased, although these differences disappeared at the highest temperature (34 °C) (Fig 1). However, at day 5, there were more parasites when they were kept at 34 °C.

The status of infection affected the total number of parasites, with the Morelos strain having a lower number of parasites in the rectum at all three temperatures compared to the Chilpancingo strain (Fig. 1). The incubation time was also a good predictor, where over time there was an increase in the number of parasites in both the Morelos and Chilpancingo strains (20 °C to 30 °C). This effect was inverted, however, at 34 °C, in which the Morelos strain had its peak number of parasites at 10 days and the Chilpancingo strain had its peak at 15 days (Fig. 1).

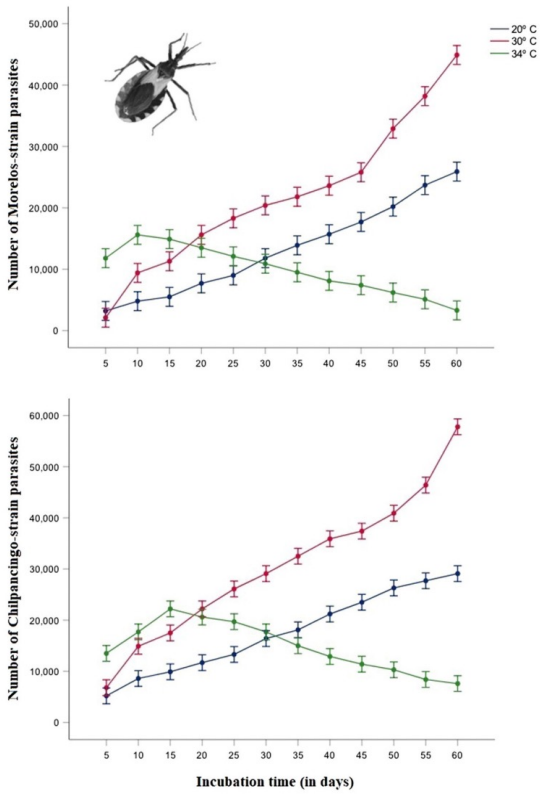


Fig. 1 Total number of parasites in the rectal ampulla of fifth-instar nymphs of *Triatoma. pallidipennis* infected with the Morelos (upper) and Chilpancingo (lower) strains of *Trypanosoma cruzi.* The numbers indicate mean ± standard error

Conclusions

These results suggest negative effects on the abundance of *Trypanosoma cruzi* in *Triatoma pallidipennis* at high temperatures. This is the first evidence of the effect of high temperatures on a pathogenic agent transmitted by an insect vector in the context of global warming. Further tests should be done to determine whether this pattern occurs with other triatomine species and *Trypanosoma cruzi* strains.

References

SCAN ME