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OBSERVATIONS ON THE BODY TEMPERATURES AND NATURAL HISTORY OF SOME MEXICAN REPTILES

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Basic natural history information, such as data on body temperature, is lacking for many lizard species throughout the world, especially for those in non-temperate regions of the world (Vitt and Pianka, 1994), an observation that also holds true for reptiles in general. In this paper, we present observations on some basic aspects of the thermal biology and natural history of eight species of lizards (*Cnemidophorus tigris, Eumeces copei, Phrynosoma asio, P. modestum, P. orbiculare, Sceloporus horridus, S. jarrovi,* and *S. spinosus*) and four species of snake (*Conopsis biserialis, Crotalus triseriatus, Sistrurus ravus,* and *Storeria storerioides*) from México. Much of the information previously reported on the thermal biology of Mexican reptiles was among the first data on thermoregulation in reptiles in general (Cowles and Bogert, 1944; Bogert, 1949); however, little work has been done since then. Our observations will hopefully serve to fill some of the gaps in or knowledge and hopefully serve to suggest future research on these reptiles.

Materials and Methods

Lizards were captured by noose. Body temperatures (T_b; to the nearest 0.1° C) were obtained using quick reading cloacal thermometers. Care was taken to prevent temperature from being influenced by handling and all lizards requiring extensive effort to capture were excluded for purposes of temperature records. Body temperatures were collected from active lizards of snakes (i.e., foraging or basking). Collections were concentrated in the morning throughout the study. Air temperature (T_a; at 5 cm above substrate where lizard or snake was first observed, using a shaded bulb to nearest 0.1° C) and substrate temperature (T_s; on substrate where lizard or snake was first observed, using a shaded bulb to nearest 0.1° C) were measured at the site of capture. We also measured snout-vent length (SVL; to nearest mm) using a ruler.

All measurement are reported as mean ± one standard error. In many cases, Mann-Whitney U or Kruskal-Wallis tests were used because

sample sizes were often very unequal. In all other tests, standard parametric analyses were performed.

Results and Discussions

LIZARDS

Cnemidophorus tigris

Locality: Corros Colorados, Chihuahua

The mean SVL of the C. *tigris* was 64.8 ± 4.3 mm (N = 6; range 57-86). Mean T_b was 39.5 ± 0.4° C (N = 6; range 37.9-40.1° C), mean T_a was 27.1 ± 0.4 ℃ (N = 6; range 25.4-28.6° C), and mean T_s was 32.6 ± 1.6 ° C (N = 6; range 27.6-38.6° C). Body temperature was not quite significantly related to T_s (N = 6, r^2 = 0.57, P = 0.08), but T_a did explain a great deal of the variation in T_b. There was not a significant relationship between T_b and T_s (N = 6, r^2 = 0.04, P = 0.71). All individuals were first observed on open ground.

Eumeces copei

Locality: Cahuacán, México

We collected temperature observations from five *E. copei*. These individuals has a mean T_b of 28.7 ± 1.4° C, a mean T_a of 24.7 ± 2.2° C, and a mean T_s of 39.5 ± 0.4° C. Of the five individuals, four were found under rocks and one was found on the edge of a water canal. One of the individuals was a gravid female found on 7 June 1992.

Phrynosoma asio

Locality: 14.0 km S of Mezcala, Guerrero

Phrynosoma asio captured for this studied average 87.1 ± 3.1 mm (N = 32) in SVL. Mean T_b for *P. asio* was 32.4 ± 0.8° C (N = 32), mean T_a was 27.2 ± 0.6° C (N = 32), and mean T_s was 28.7 ± 0.7° C (N = 32). Body temperature increased with T_a (N = 32, r^2 = 0.75, P < 0.0001; T_b = 1.36 +1.14 T_a) and T_s (N = 32, r^2 = 0.60, P < 0.0001; T_b = 9.54 + 0.80 T_s). Body temperature was not significantly influenced by body size (N = 32, r^2 = 0.002, P = 0.79). Males (least squares mean: 33.0 ± 0.5° C, N = 17) had a slightly higher mean T_b compared to females (least square mean:

32.3 ± 0.6° C, N = 14), but the difference was very small (ANCOVA: $F_{1,27}$ = 5.17, P + 0.03). There seas some indication that the relationship between T_a and T_b may differ between males and females (e.g., the interaction between T_a and sex in the ANCOVA was significant; $F_{1,27}$ = 4.72, P = 0.04). Males and females did not differ in T_a (df = 29, t = 1.00, P = 0.33), nor T_s (df = 29, t = 1.43, P = 0.16).

Phrynosoma modestum

Locality: Corros Colorados, Chihuahua

The mean T_b of two *P. modestum* was 20.9 ± 1.5°C, with the mean T_a being 20.3 ± 0.2° C and the average T_s being 21.1 ± 0.3° C. Both individuals were observed on the open ground.

Phrynosoma orbiculare

Locality: Cerro Calacoaya, Bellavista, México

The average T_b of two *P. orbiculare* was 37.9 ± 0.2° C, with the average T_a being 25.4 ± 0.2° C and the average T_s being 27.6 ± 0.2° C. Both individuals were observed on the open ground.

Sceloporus horridus

Locality: Zitlala, Guerrero

The mean SVL of the *S. horridus* was 57.4 ± 4.0 mm (N = 14). Mean T_b for *S. horridus* was 36.8 ± 0.4 ° C (N = 14), mean T_a was 25.5 ± 0.8 ° C (N = 14), and mean T_s was 29.5 ± 1.1° C (N = 14). Body temperature was not significantly related to T_a (N = 14, r^2 = 0.02, P = 0.63), nor T_s (N =14, r^2 = 0.002, P = 0.88). Body size did not have any affect on T_b (N = 14, r^2 = 0.18, P = 0.13).

Sceloporus jarrovi

Locality: Atlas Cumbres, Tamaulipas

The mean SVL of the *S. jarrovi* was 68.0 ± 4.8 mm (N = 6). Mean T_b for *S. jarrovi* was 25.4 ± 0.7° C (N = 6; range 23.8-27.8° C), mean T_a was 23.3 ± 0.2° C (N = 6; range 22.6-24.2° C), and mean T_s was 23.9 ± 0.5° C (N = 6; range 22.9-26.4). Body temperature was significantly related to T_a (N = 6, r^2 = 0.65, P = 0.05; T_b = -26.2 + 2.2T_a), and T_s (N = 6, r^2 = 0.71, P = 0.036; T_b = -0.98 + 1.1 T_s). All individuals were first seen associated with rocks, either on or under the rocks or in crevices.

Sceloporus spinosus

Locality: Arcos del Sitio, México

The mean SVL of the *S. spinosus* was 84.38 ± 8.40 mm (N = 8; range = 52-107 mm). Mean T_b was 33.52 ± 0.86 ℃ (N = 8; range 29.9-37.2° C). Air temperature averaged 23.11 ± 0.99° C (N = 8; range 19.5-26.8° C) and T_s averaged 25.76 ± 1.33° C (N = 8; range = 21.4-30.4° C). The regressions of T_b on T_a (N = 8, r^2 = 0.12, P = 0.41) and T_s (N = 8, r^2 = 0.04, P = 0.63) were not statistically significant.

SNAKES

Conopsis biserialis

Locality: Sta. Lucia, Morelos

Conopsis biserialis had an average T_b of 21.81 ± 1.08° C (N = 7; range + 18.4-25.6° C). Air temperatures averaged 18.52 ± 0.69°C (N =7; range 17.1-22.2° C) and T_s averaged 20.1 ± 0.89° C (N = 7; range = 17.2-22.8° C). The regression of T_b and T_a was not statistically significant (N = 7; r^2 = 0.37, P = 0.15). However, the regression of T_b on T_s was statistically significant (N = 7, r^2 = 0.90, P = 0.0011; $T_b = -1.33 + 1.15T_s$), suggesting thigmothermy. All individuals ere found on the ground under agave leaves.

Crotalus triseriatus

Locality: km 19.5 highway Ajusco-Xalatlaco

The *Crotalus triseriatus* captured in this study had an average T_b of 26.24 ± 1.05° C (N = 10; range 20.4-33.4° C). Air temperatures averaged 14.24 ± 0.28° C (N = 10; range = 12.7-15.8° C) and T_s averaged 18.69 ± 0.90° C (N = 10; range = 13.6-24.3° C). The regression of T_b on T_a was not statistically significant (N = 10; r^2 = 0.003, P = 0.87). However, the regression of T_b on T_s was statistically significant (N = 10, r^2 = 0.59, P = 0.01; $T_b = 9.50 + 0.90T_s$), suggesting *C. triseriatus* are thigmothermic. This conclusion is further supported by the fact that T_bs on sunny days and cloudy days were not significantly different (Mann Whitney U, Z = -1.36, P = 0.17).

Sistrurus ravus

Locality: Sta. Lucia, Morelos

The *Sistrurus ravus* had average T_b of 21.32 ± 0.84° C (N = 6; range = 18.6-23.3° C). Air temperatures averaged 17.87 ± 0.49° C (N = 6; range 16.8-19.6° C) and T_s averaged 19.07 ± 0.84° C (N = 6; range = 16.9-22.4° C). The regression of T_b on T_a was not statistically significant (N = 6; r^2 = 0.46, P = 0.14), nor was the regression of T_b on T_s (N = 6, r^2 = 0.34, P = 0.22); however, I both cases environmental temperatures did explain a great deal of the variation in T_b. All individuals were found on the ground under agave leaves. In one case two individuals were found under the same leaf.

Storeria storerioides

Locality: Sta. Lucia, Morelos

Storeria storeriodes had a mean T_b of 20.20 ± 1.45° C (N = 6; range 14.4-24.8° C). Air temperatures averaged 18.80 ± 1.20° C (N = 5; range 14.4-23.2° C) and T_s averaged 20.1 ± 1.24° C (N = 6; range 14.8-23.2° C). The regression of T_b on T_a was not statistically significant (N = 6, r^2 = 0.19, P = 0.38), nor was the regression of T_b on T_s (N = 6, r^2 = 0.44, P = 0.15); however, T_s did explain a great deal of the variation in T_b. All individuals were found on the ground under agave leaves.

Our results point out the variability in thermal biology among Mexican reptiles. Our results also suggest that each species may exhibit different thermoregulatory behaviors. For example, *Crotalus triseriatus* would appear to be thigmothermic, whereas *Cnemidophorus tigris* would appear to be heliothermic. The low sample sizes preclude definitive conclusions, but the results suggest that Mexican reptiles represent an underutilized resource in our understanding of the thermal biology or reptiles, and ectotherms in general.

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