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TEMPERATURE RELATIONSHIPS OF THE TROPICAL TREE LIZARD (*UROSAURUS BICARINATUS*) FROM THE CAÑÓN DEL ZOPILOTE, GUERRERO, MÉXICO

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Tree lizards of the genus *Urosaurus* live in a diversity of habitats ranging from xeric to mesic conditions (Wiens, 1993). Each habitat presents the individuals living in them with unique thermal environments. For example, tree lizards living in desert habitats will be exposed to higher ambient temperatures than tree lizards living in mountain habitats (Smith & Ballinger, 1995). Such contrasts in environmental temperatures may not necessarily lead to differences in active body temperatures. For example, desert and mountain habitats supporting populations of *Urosaurus ornatus* in south-eastern Arizona and south-western New Mexico had different air temperatures, but lizards did not differ in body temperatures or thermal tolerance (Smith & Ballinger, 1994, 1995). However, *U. ornatus* and *U. graciosus* in a different habitat (desert riparian) have slightly higher body temperatures than *U. ornatus* from the desert and mountain populations (Vitt, Van Loben Sels, & Ohmart, 1981; Smith & Ballinger, 1995). Thus, there does appear to be intrageneric variation in active body temperature. To determine if there is a phylogenetic component and/or an environmental component to this variation, additional information on other species from different habitat types and localities is needed. In this note, we report on the temperature relationships of *U. bicarinatus* from an arid tropical scrub habitat in Guerrero, México. Little else is known about the biology of this species (see Ramírez-Bautista, Uribe-Peña, & Guillette, 1995), and, except for *U. ornatus* and *U. graciosus*, the genus in general (Wiens, 1993).

Our study was conducted in the Cañón del Zopilote north of Chilpancingo, Guerrero (600 m elevation), 14 km south of Mexcala, a small town on the Rio Balsas. The area is situated in arid tropical scrub (the most xeric portion of the Bosque Tropical Caducifolio of Rzedowski, 1988). Dominant vegetation includes a variety of cacti including large *Neobuxbaumia* spp., and trees such as *Bursera* spp., *Acacia* spp., *Lysiloma tergemina*, *Mimosa benthami*, *Ficus contifolia*, *Ficus petiolaris*, and *Pithecellobium dulce*, among other species. The area lies in the rain shadow of the Sierra Madre del Sur which makes the interior Balsas River basin extremely xeric. There is a pronounced rainy season from late May until September at which time the late afternoon and evening storms produce torrential rains. *Urosaurus bicarinatus* is active throughout the year.

A total of 81 lizards were captured by hand or by shooting with a rubber band. 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. Body temperatures were only collected from active lizards (i.e. foraging or basking). Due to logistic constraints, collections were concentrated in the morning throughout the study. Air temperature (T_a; at 5 cm above substrate where lizard was first observed, using a shaded bulb to nearest 0.1°C) and substrate temperature (T_s; on substrate where lizard 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. Standard parametric analyses were performed. All measurements are reported as mean $\pm$ one standard error. Least squares means (LSM) from analysis of covariance are often used to represent means corrected for differences in T_a.

All lizards collected were observed on *Acacia* trees. Mean SVL was 40.8 $\pm$ 0.7 mm. Males were larger than females [42.1 $\pm$ 0.9 mm ($n = 51$) vs. 38.6 $\pm$ 0.9 mm ($n = 30$); df = 79, $t = 2.61$, $P = 0.011$]. Body temperatures averaged 34.6 $\pm$ 0.6 °C. The T_a at the site of capture had a mean of 29.9 $\pm$ 0.4 °C, and the T_s at the site of capture had a mean of 31.6 $\pm$ 0.6 °C. Air and surface temperatures were closely related ($r^2 = 0.88$, $P < 0.0001$; $T_s = -4.84 + 1.22T_a$). Body size (SVL) did not have a significant influence on T_b ($r^2 = 0.004$, $P = 0.56$), T_a ($r^2 = 0.005$, $P = 0.52$), or T_s ($r^2 = 0.002$, $P = 0.72$).

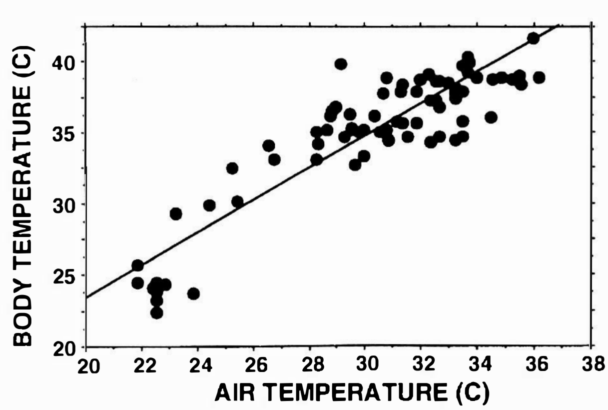

FIG. 1. Least squares regression of body temperature vs. air temperature for *Urosaurus bicarinatus*. The regression equation is provided in the text.

Body temperature was positively correlated with T_a (Fig. 1; $r^2 = 0.82$, $P < 0.0001$; $T_b = 0.85 + 1.13\ T_a$), as well as T_s ($r^2 = 0.81$, $P < 0.0001$; $T_b = 7.26 + 0.86\ T_s$). There was a positive relationship between the time of day and T_b ($r^2 = 0.61$, $P < 0.0001$; $T_b = 14.6 + 1.9$ Hour). Air temperature ($r^2 = 0.61$, $P < 0.0001$; $T_a = 14.0 + 1.5$ Hour) and T_s ($r^2 = 0.004$, $P = 0.56$; $T_s = 11.4 + 1.9$ Hour) also increased as the day progressed (at least into early afternoon).

Males (LSM: 35.0 $\pm$ 0.3 °C) had a slightly higher mean T_b than females (LSM: 33.9 $\pm$ 0.4 °C) (ANCOVA with T_a as covariate; $F_{1,78} = 4.78$, $P = 0.03$). The interaction between sex and T_a was not significant, suggesting that the slopes of the T_b on T_a regression did not differ between males and females (this interaction term was therefore not included in the final analysis). Males and females did not have different T_a's (29.8 $\pm$ 0.56 °C vs. 30.2 $\pm$ 0.7 °C; df = 79, $t = -0.47$, $P = 0.64$) or T_s's (31.6 $\pm$ 0.76 °C vs. 31.5 $\pm$ 0.9 °C; df = 79, $t = 0.12$, $P = 0.91$).

The mean T_b of *U. bicarinatus* reported here is very similar to the mean T_b's of the desert and montane populations of *U. ornatus* (34.8°C and 35.0°C, respectively) in Smith & Ballinger (1995), but 2-3°C less than the means for *U. ornatus* and *U. graciosus* in desert riparian habitats in Vitt *et al.* (1981). Air temperatures in this study were on average higher than those found at either site in Smith & Ballinger (1995), but slightly lower than the T_a's in Vitt *et al.* (1981). The fact that the populations of *U. ornatus* in the desert riparian, and the desert and montane habitats differ more than some of the species do, suggests that something in addition to phylogenetic relationships may be determining active body temperatures in the genus *Urosaurus*.

Local environmental conditions may be partially responsible for some of the observed differences. The fairly high T_b's of the central Arizona *U. ornatus* and *U. graciosus* may be related to the high ambient temperatures of their habitats (see Vitt *et al.*, 1981), compared to the relatively lower ambient temperatures for the desert and low montane *U. ornatus* (Smith & Ballinger, 1995) and arid tropical scrub *U. bicarinatus.* Indeed, local mean T_a for 26 populations of lizards in the genus *Sceloporus* accounted for just over 50% of the variation in mean T_b (Lemos-Espinal, Smith, & Ballinger, in press).

Another important consideration may be the degree of arboreality of the species in question. *Urosaurus bicarinatus* appears to be strictly arboreal: no individuals were observed on the ground, and all individuals remained in trees during capture. These findings support the assertion that the clade including *U. bicarinatus* is strictly arboreal (Wiens, 1993). The importance of arboreality and terrestriality arises when the microclimate of a perching lizard is considered. Different perches can have different biophysical properties (see Bakken, 1989) and thus for a given T_a, individuals on different perches can have different T_b's. Such considerations may help explain the differences in T_b observed in the studies on *Urosaurus,* since each species tends to vary in the extent of their arboreality. Indeed, in *U ornatus* in a low montane habitat, individuals using different substrates did in fact have different T_b's (Smith & Ballinger, 1995). At this time we do not have enough information to make any conclusions about the sources of active body temperature variation in the genus *Urosaurus*, but hope that more data will be forthcoming to allow for additional analyses.

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