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Diet and sexual dimorphism in the Curly tail Lizard *Leiocephalus macropus* (Sauria: Tropiduridae) at Yacabo Abajo, Guantanamo Province, Cuba

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The genus *Leiocephalus* (family: Tropiduridae) is present in Florida, Cuba, the Cayman Islands, the Bahamas, and Hispaniola (Etheridge 1966; Meshaka et al. 2005), and *Leiocephalus macropus* is one of six species found on Cuba, where it is endemic (Garrido 1973; Schwartz and Thomas 1975). Although this genus has a broad distribution and several studies on diet, sexual dimorphism, growth, reproduction, thermal ecology, anti-predator behavior and social signals of some species have been made, the knowledge on ecology and biology of *Leiocephalus* species still poor (Marcellini and Jenssen 1989, 1991; Cooper 2001; Nelson et al. 2001; Smith and Nickel 2002; Meshaka et al. 2006; Gifford and Powell 2007; Gifford et al. 2008). In genus *Leiocephalus*, all species are sexually dimorphic in body size, with males larger than females. Several studies investigate the possible causes of the sexual dimorphism observed in this genus throughout its distribution range (Schoener et al. 1982; Smith 1992; Nelson et al. 2001; Smith and Nickel 2002; Gifford and Powell 2007). However, no definitive explanation has been found yet. The study of the trophic niche and morphology of organisms permits the exploration of different ecological and evolutionary phenomena in animals (Metzger and Herrel 2005; Pincheira-Donoso 2008). Thus, the objective of this work was to provide data on the diet of the Curly-tailed lizard *Leiocephalus macropus macropus* (Cope, 1862) and on the sexual dimorphism of the sub-species in Guantanamo Province, Cuba.

The study was conducted in December 2006 at a locality 2.8 km northwest of Yacabo Abajo, in Guantanamo Province, Cuba. The climate at this locality is semi-arid; this region has the lowest annual precipitation recorded in Cuba (600-800 mm). The vegetation is xeromorphic, with an abundance of succulents, microphylous and thorny plants, largely due to the prevailing climatic and soil conditions. The vegetation is distributed as a mosaic of forests and shrub woods that vary according to the soil type, exposure and altitude. Along the coast, xeromorphic scrub and dry microphylous forest dominate (Capote and Berazaín 1984; Reyes 2006).

We found *L. m. macropus* in secondary vegetation near a stream-bed, in sympatry with *L. raviceps raviceps*; both species are syntopic at several sites. Individuals were observed on rocks, the ground (sandy and rocky substrates), and tree trunks up to 1 m high. We captured lizards by noosing between 1000 hr and 1200 hr. We collected 22 specimens (nine males and 13 females) and measured their snout-vent length (SVL; ± 0.001 mm) with a Vernier caliper and mass (M; ± 0.05 g) with a 100 g Pesola dynamometric balance. We placed each individual in a plastic container (160 x 50 x 100 mm) where it remained for five to eight days in order to obtain fecal pellets (Fong and Garcés 2002). We obtained 43 fecal pellets which we hydrated and spread independently in a Petri dish to identify diet contents. We examined prey items using a stereoscopic microscope and identified each to the lowest taxon possible, and tallied total prey items per taxon numerically. The method of fecal pellet examination to determine diet of reptiles and amphibians has been criticized and compared with other methods by Pincheira-Donoso (2008). This author found that fecal samples provide inaccurate results on lizard diet because soft-bodied organisms are destroyed by digestive processes and may be absent from feces (Pincheiro-Donoso 2008). However, here we prefer to use this method than other invasive methods like stomach flushing or gastric contents removal from dissected stomachs (Pincheiro-Donoso 2008).

Fecal pellets contained 1578 prey items, belonging to 11 taxonomic groups (Table 1) including unidentified items. Invertebrates were the most common prey items in the diet, with Hymenoptera (ants) accounting for 83.4% and 81.3% of the prey items by number in males and females, respectively. Insect larvae were the second most frequently consumed item by both sexes. Six other insect orders (Coleoptera, Isoptera, Lepidoptera, Hemiptera, Dictyoptera and Orthoptera) and two groups of arachnids (Araneae and Acarina) were found in lower proportion. During the study we also observed a male of L. m. macropus (SVL=88.3 mm and M=23.6 g) capture and eat a juvenile *Anolis sagrei* (SVL=29.7 mm). The diet did not differ between males and females (G-test; G_9=3.59, p=0.609).

The diet of *L. m. macropus* determined in this study is consistent with previously recorded diets of *Leiocephalus* species which are considered omnivorous consuming vegetation, sap, insects and vertebrates (Sampedro et al. 1979; Schoener et al. 1982; Floyd and Jenssen 1983; Armas 1987; Rodríguez Schettino and Martínez Reyes 1994; Fong and Garcés 2002; Smith et al. 2008). Although herbivory has been observed in several species of *Leiocephalus* (Schoener et al. 1982; Nelson et al. 2001), we did not find plant matter in fecal pellets from lizards in our study. Saurophagy, cannibalism and necrophagy have been reported in other species of *Leiocephalus* (Schoener et al. 1982; Armas 1987; Martínez Reyes and Rodríguez Schettino 1987; Martínez Reyes et al. 1990; Fong and del Castillo 2002; Martínez Reyes and

TABLE 1. Number (n) and proportion (%) of prey items found in 43 fecal pellets of 22 *Leiocephalus macropus macropus* collected at Yacabo Abajo, Guantánamo province, Cuba.

Taxon	**Males (n=9)**		**Females (n=13)**		**Total (n=22)**	
	n	**%**	**n**	**%**	**n**	**%**
INSECTA						
Hymenoptera (ants)	780	83.42	523	81.34	1303	82.57
Coleoptera	35	3.74	29	4.51	64	4.06
Lepidoptera	12	1.28	9	1.40	21	1.33
Isoptera	3	0.32	2	0.31	5	0.32
Hemiptera	4	0.43	2	0.31	6	0.38
Dyctioptera	1	0.11	1	0.15	2	0.13
Orthoptera	1	0.11	0	0.00	1	0.06
Insects' larva	75	8.02	60	9.33	135	8.55
Unidentified items	21	2.25	12	1.87	33	2.09
ARACHNIDA						
Araneae	2	0.21	3	0.47	5	0.32
Acarina	1	0.11	2	0.31	3	0.19
TOTAL	**935**	100	**643**	100	**1 578**	100

Moreno García 2003; Iverson and Smith 2006), but these events are typically rare (Schoener et al. 1982).

Mean SVL was 85.43 ± 4.08 mm (range: 78.9–91.2) in males and 59.62 ± 5.44 mm (range: 50.3–67.9) in females, and mean body mass was 22.96 ± 2.57 g in males and 8.71 ± 0.78 g in females. As found in other studies on *L. macropus* and in general for *Leiocephalus* (Sampedro et al. 1979; Smith 1992; Rodríguez Schettino 1999; Nelson et al. 2001; Smith and Nickel 2002; Gifford and Powell 2007), sexual dimorphism in body size was also well-developed in our sample of *L. m. macropus*, with males having been significantly larger and heavier than females (t_{20}=18.23, p<0.05 and t_{20}=11.91, p<0.05, respectively). The sexual size dimorphism index (SSDI; mean male SVL:mean female SVL) was 1.43; greater than those reported for this species and other *Leiocephalus* lizards from Cuba, Dominican Republic and Bahamas Archipelago (Smith and Nickel 2002; Gifford and Powell 2007). Sexual dimorphism may be adaptive and several hypotheses have been proposed to explain morphological differences among sexes in the genus *Leiocephalus* (Gifford and Powell 2007). Larger males may outcompete smaller males for mates and are more likely to reproduce, potentially leading to the evolution and maintenance of sexual dimorphism (Anderson and Vitt 1990). Sexual dimorphism could permit each sex to utilize different resources, thus decreasing intraspecific competition, whereby the greater length and mass in males allows them to ingest larger prey items than females (Schoener 1967; Shine 1989; Herrel et al. 1996). The greater biting capacity of larger males with larger heads is a third explanation for sexual dimorphism. An enhanced biting capacity may provide an advantage to larger males in male-male combats and may also increase chances of successful fertilization during copulation (Herrel et al., 1996). Another explanation for sexual dimorphism could be differential growth between sexes due to ecological, physiological or behavioral factors, such as the difference in energy investment in growth after maturity between males and females (Gifford and Powell 2007 and literature therein). We are not presently able to test all hypotheses for the cause of sexual dimorphism in *L. m. macropus*. However, as noted previously in *Leiocephalus* species, we detected no difference in diet between males and females which suggests that the niche divergence hypothesis (Schreiber et al. 1993; Micco et al. 1997; Nelson et al. 2001) does not explain the sexual dimorphism observed in *L. m. macropus* of this population. However, this conclusion is tentative in light of the seasonal restriction of our collection.

Our findings in this population of L. m. macropus conform to the general pattern of larger male mean body size and overlapping diet between the sexes in the genus *Leiocephalus.* We recommend that future studies take additional morphological measurements (e.g. head dimensions) as it might relate to diet or behavior, incorporate different seasons in diet analyses, and investigate a wide variety of populations, spanning different habitat types, in order to test the factors underlying sexual dimorphism in *L. macropus*. Reproduction, especially clutch size should also be studied as reproductive characteristics could play a role in sexual dimorphism (Gifford and Powell 2007).

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