Diet of juvenile tegu lizard *Tupinambis merianae* (Teiidae) in southeastern Brazil

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The lizard genus *Tupinambis* Daudin is restricted to South America and encompasses the largest species of the American family Teiidae (Milstead, 1961). For the non-Amazonian populations formerly known as *Tupinambis teguixin* (Linnaeus, 1758), the name *Tupinambis merianae* (Duméril and Bibron, 1839) is now available (Ávila-Pires, 1995), the latter name being used here. The common tegu, *T. merianae*, is recorded from Brazil south of Amazon River, northern Argentina and Uruguay, where it is widely distributed and inhabits both forested and open areas, being common in disturbed (anthropic) habitats (Vanzolini et al., 1980; Sazima and Haddad, 1992; Ávila-Pires, 1995).

Tupinambis merianae is known to feed on a wide range of animals and plants in Brazil (Vanzolini et al., 1980; Lopes, 1986; Sazima and Haddad, 1992), yet little is published on its natural history, most information on its diet being based on casual observations or analyses of a few individuals (Milstead, 1961; Ávila-Pires, 1995; Martuscelli and Olmos, 1996). The diet of adult *T. teguixin* (= *T. merianae*) was studied to some detail in Argentina (Mercolli and Yanosky, 1994). Herein we report and comment on the diet and feeding habits of juvenile individuals from southeastern Brazil, and add to the natural history of this ubiquitous yet still poorly known lizard.

Thirty-five juvenile specimens of *T. merianae* preserved in the herpetological collections of the Museu de História Natural da Universidade Estadual de Campinas (ZUEC) and Museu de História Natural Capão da Imbuia (MHNCI) were examined for stomach contents. All specimens were preserved in ethanol, and originated from the States of São Paulo and Paraná. Snout-vent length (SVL) was measured with a metric scale to the nearest mm. The lizards were dissected and checked for sex (gonads), and their stomach contents were analysed qualitatively and quantitatively (frequency of occurrence, numerical percentual, and volume). Food items were identified to order and, in a few cases, to lower categories. Plant food was categorised as leaves, flowers, fruits and seeds. The volume of each item was estimated with displacement of alcohol 99% (Korschgen, 1987).

We examined 19 males and 16 females, range 87-299 mm SVL (mean $\pm$ s = 185.7 $\pm$ 55.0 mm), and 30 of them yielded stomach contents. In previous dietary studies, 15 individuals were regarded as the minimum sample for *Tupinambis rufescens* (Williams et al., 1993), whereas 27 ones were regarded as the minimum sample needed to estimate 80% of the diet of *T. merianae* (Mercolli and Yanosky, 1994).

Diet of juvenile *T. merianae* includes invertebrates, vertebrates and plants (table 1). Invertebrates were the most common food category in number (90.6%), volume (47.7%) and frequency (93.3%). Coleopteran adults and pupae were the most numerous item (18.2%) followed by hymenopterans (15.8%), and spiders and orthopterans (11.8%).

Table 1. Diet composition of juvenile *Tupinambis merianae* (n = 30, 87-299 mm SVL) expressed in number, volume (mm^3), and frequency of ocurrence (% = relative frequency).

Item	Number	%	Volume	%	Frequency	%
Annelida Oligochaeta	1	0.3	0.3	0.1	1	3.3
Gastropoda	21	7.1	15.2	3.5	6	20.0
Crustacea Decapoda						
Grapsidae (*Aratus* sp.)	3	1.0	3.6	0.8	2	6.7
Araneae	35	11.8	45.4	10.3	20	66.7
Diplopoda	13	4.4	17.0	3.9	7	23.3
Orthoptera	35	11.8	44.7	10.2	17	56.7
Blattaria	21	7.1	30.8	7.0	10	33.3
Heteroptera	1	0.3	0.8	0.2	1	3.3
Coleoptera	54	18.2	29.6	6.7	14	46.7
Adults	37	12.5	29.4	6.7	14	46.7
Pupae	17	5.7	0.2	–	1	3.3
Diptera Calliphoridae						
Larvae	4	1.3	0.3	0.1	2	6.7
Lepidoptera	15	5.0	10.0	2.3	6	20.0
Larvae	14	4.7	7.2	1.7	5	16.7
Pupae	1	0.3	2.7	0.6	1	3.3
Hymenoptera	47	15.8	10.6	2.4	10	33.3
Formicidae	28	9.4	6.7	1.5	8	26.7
Others	2	0.7	–	–	2	6.7
Unidentified pupae	17	5.7	3.9	0.9	2	6.7
Insecta (eggs)	19	6.4	0.7	0.2	4	13.3
Amphibia Anura	2	0.7	7.2	1.6	1	3.3
Aves	2	0.7	0.7	0.2	2	6.7
Mammalia Rodentia	1	0.3	60.0	13.7	1	3.3
Muridae (*Oryzomys* sp.)						
Fruits	8	2.7	130.4	29.7	5	16.7
Arecaceae (*Syagrus* sp.)	1	0.3	5.0	1.1	1	3.3
Moraceae (*Ficus* sp.)	2	0.7	3.8	0.9	1	3.3
Musaceae (*Musa* sp.)	1	0.3	113.0	25.8	1	3.3
Unidentified	4	1.4	8.6	1.9	3	10.0
Seeds	206	–	8.6	2.0	5	16.7
Cucurbitaceae	38	–	3.8	0.9	2	6.7
Myrtaceae	123	–	1.7	0.4	2	6.7
Unidentified	45	–	3.2	0.7	5	16.7
Flowers	7	2.4	0.6	0.2	2	6.7
Unidentified	8	2.7	21.3	4.9	7	23.3
Total	**297**	**100.0**	**438.2**	**100.0**	–	–

Spiders (66.7%) and orthopterans (56.7%) were the items most frequently consumed, and Lycosidae was the most frequent spider family, found in all stomachs containing spiders (20). The beetle family Scarabaeidae had the greatest frequency of ocurrence (50%).

The most important food items by volume were spiders (10.3%), followed by orthopterans (10.2%). Thus, arthropods were the most important food both in numbers and by volume, a result similar to that recorded for eight tegu individuals (presumably adults) in Rio

Grande do Sul State, southern Brazil (Milstead, 1961, as *T. teguixin*). Food items such as the banana *Musa* sp. and the cricetine rodent *Oryzomys* sp. showed the greatest volumetric contribution in the diet but were found in a single lizard each (table 1). Shells of snails were found unbroken and partly digested (see comments on quick shell digestion in Williams et al., 1993; Mercolli and Yanosky, 1994).

Plant food is important both numerically and volumetrically in the diet of adult *T. merianae* from Argentina (Mercolli and Yanosky, 1994). The fruit and seeds consumed by the individuals studied herein were found in one and two stomachs respectively; these small numbers are likely due to the undifferentiated teeth of juveniles (Presch, 1974), as well as the greater need of juveniles for animal protein than that of adults (Pough, 1973). *Tupinambis merianae* is regarded as an important seed disperser (Castro, 1999), a trend which appears early in its life (present study).

The high frequency of millipedes (23.3%) we found in the diet of juvenile *T. merianae* weakens the suggestion of Lewis (1989), that active foraging lizards avoid millipedes due to their noxious secretions. Williams et al. (1993) already recorded a relatively high frequency of occurrence of millipedes in the diet of adult *T. rufescens* in Argentina.

Necrophagy (carrion-eating) by juvenile tegus is here indicated by the calliphorid fly larvae found in the stomach contents, as maggots of these flies occur in carcasses of several vertebrate taxa (Monteiro-Filho and Penereiro, 1987). Moreover, in the field we recorded a subadult *T. merianae* feeding on the carcass of a nine-banded armadillo (*Dasypus novemcinctus*) and a juvenile feeding on a rotten nestling of the house sparrow (*Passer domesticus*) on the ground. The ability of juvenile tegus to discriminate potential prey odours well, regardless of their previous feeding experience (Cruz-Neto and Andrade, 1993), makes it likely that carrion would be consumed when the opportunity arises, as feeding on this resource type involves low energy cost and no risk, when compared to the costs in catching and subduing live prey (see this view for snakes in Sazima and Strüssmann, 1990). Necrophagy in both *T. merianae* and *T. rufescens* is already recorded (Vanzolini et al., 1980; Donadío and Gallardo, 1984; Sazima and Haddad, 1992), but no mention of juveniles is made.

Arthropods found in the litter or under fallen logs (e.g., spiders, beetles, orthopterans, ants, and cockroaches) were the most common prey of *T. merianae* juveniles in our study. This result, together with the consumption of fruits, seeds, and carcasses, strengthens the view that the tegu is an active forager early in its life, a strategy typical of teiid lizards (Pianka, 1966; Schoener, 1971).

Juvenile *T. merianae* may be regarded as opportunistic and omnivorous foragers, as already recorded for adults in Argentina (Mercolli and Yanosky, 1994). Contrary to the findings on *T. rufescens* (Williams et al., 1993), our study supports the suggestion of Presch (1974) that the tegu changes its diet gradually as its teeth become differentiated, juveniles feeding more on arthropods and less on other food types than the adults do (Mercolli and Yanosky, 1994; present study). The opportunistic foraging and the broad diet of *T. merianae* (and other *Tupinambis* species as well) probably appear early in its development

and increase as it grows larger, even if juveniles do not show the differentiated teeth of the adults (Presch, 1974). The omnivory of the tegu likely relates to its successful colonisation of disturbed habitats (Norman, 1987; Sazima and Haddad, 1992).

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