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PRELIMINARY DATA ON THE DIET OF JUVENILE *VARANUS EXANTHEMATICUS* (SAURIA: VARANIDAE) IN THE COASTAL PLAIN OF GHANA

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Monitor lizards show very large differences in size from juvenile to adult that are sometimes accompanied by a shift in diet to larger prey. The most extreme example is *Varanus komodoensis*, in which juveniles are insectivorous whilst adults sometimes kill prey weighing more than 500 kg (Auffenberg, 1981). Despite their relatively large size, most adult monitor lizards feed mainly on small prey (Losos & Greene, 1988). There have been few investigations into the diets of juvenile monitor lizards. Auffenberg & Ipe (1983) and Auffenberg (1994) examined the gut contents of 92 juvenile (defined as less than one year old) *Varanus bengalensis* from various locations in the Indian subcontinent and found mainly ants, beetles, isopterans, fly larvae and orthopterans. Adults took greater quantities of the same prey (except ants), along with lesser numbers of crabs, mammals, reptiles and amphibians. Angelici & Luiselli (1999) reported no difference in diet composition of adult and juvenile *Varanus niloticus ornatus* in south-eastern Nigeria.

Here I report on the diet of juvenile (six to seven months old) Bosc's monitor lizards (*V. exanthematicus*) in the Great Accra Region of Ghana, as determined by stomach flushing and faecal sampling. *V. exanthematicus* is a small monitor lizard, about 500 mm snout-vent length (SVL), that inhabits grasslands throughout West Africa. In the study area, reproduction occurs in November and December during the hot, dry season, and eggs hatch at the beginning of the rainy season in March and April (personal observation). Stomach flushings were taken from 16 animals caught on 13 September 1994 at Abokobi (5°E42' N, 0°E11' W) and 12 animals caught at Ayi Myensah (5°E46' N, 0°E10' W), on 14 September 1994. Both of these sites are located in southern Ghana, with Ayi Myensah lying about six miles to the north-east of Abokobi. Faecal samples were taken from 24 animals at Ayi Myensah on 28 and 29 August 1994. Animals were caught by excavating burrows in fields of cassava, maize, peppers and tomatoes. Stomach flushings were obtained using a lubricated 7 mm diameter tube, inserted into the stomach via the oesophagus, through which a constant flow of water was passed until no more prey items were evacuated. Faecal samples were obtained by handling the animals after capture, usually for no more than a minute. Animals were marked and released after examination. The alimentary contents of two animals, killed accidentally during excavation at Ayi Myensah, were also examined. Prey items were identified to ordinal level and counted. All fragments other than single limbs were recorded as prey. Intact body mass of some prey types was estimated by comparison with specimens collected locally.

All samples reported upon here were collected from different animals. However, because of inconsistent labelling, samples could not be assigned with certainty to individual lizards within each location. There was no significant difference in mean SVL between the stomach-flushed animals and those from which faecal samples were collected (mean±SD= 179 mm±24.6 mm and 175 mm±21.6 mm, respectively). Body mass data are available for stomach-flushed animals only: mean body mass± SD= 109±32 g, range 56-175 g, n= 26). Dissected animals weighed 97 g (SVL= 147 mm) and 60 g (SVL= 145 mm).

Orthopterans were the most common prey in both stomach flushings and faeces, representing 76% and 85% of prey overall (Table 1), followed by scorpions (10% in both samples) and coleopterans (7% and 3%, respectively). Frogs were not detected in faeces, but represent 5% of prey in stomach flushings. Hymenopterans accounted for 2% of prey in both samples. Twenty-four stomach flushings (86%) and 25 faecal samples (100%) contained orthopterans; they included giant crickets (*Brachytrupes* sp.), locusts and small crickets. Locusts weighed 1-2 g, *Brachytrupes* 3-4 g and other crickets less than 0.5 g. In the field, *Brachytrupes* and locusts were usually encountered singly, but congregations of 5-20 or more small crickets were often found in burrows during searches for lizards. Eight faecal samples (32%) and six stomach flushings (21%) contained scorpions: one was a buthid, with an original mass of 1.5 g; the others were *Pandinus imperator*, weighing about 6-7 g. Three stomach-flushed animals (11%) had eaten unidentified ranid frogs weighing 12-15 g. Two faecal samples (8%) and four stomach flushings (14%) contained beetles of unknown types, all weighing less than 1 g. Three lizards had eaten wasps (8% of faecal samples and 4% of stomach flushings), for which no estimates of weight are available. Both dissected lizards contained pieces of shell of snails, for which no weights could be estimated. One of the dissected animals also contained a scorpion (*P. imperator*) and two orthopterans (a *Brachytrupes* and a small cricket); the other also contained three orthopterans (one *Brachytrupes* and two small crickets). Prey:predator mass ratios for the dissected lizards

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TABLE 1. Diet of *Varanus exanthematicus* in Ghana, determined by stomach flushings and faecal samples.

Prey type	% of total prey items		% occurrence in samples	
	Faeces	Flushings	Faeces	Flushings
Orthopterans	85	76	100	86
Scorpions	10	10	32	21
Coleopterans	3	7	8	14
Frogs	0	5	0	11
Hymenopterans	2	2	8	4

were 0.08 and 0.11. There was no significant difference between the mean numbers of prey recorded from stomach flushings at Abokobi (mean no. prey items = 2.3, n= 16) and Ayi Myensah (mean no. prey items= 1.9, n=12; t=0.902, P>0.05). Overall, however, faecal samples contained more prey items (mean=3.8) than stomach flushings (mean=2.1; t=4.87, P<0.01).

Amphibians were not found in faecal samples, but otherwise there were no obvious differences in relative proportions of prey recorded from stomach flushings and faecal samples. Others have also commented on an absence of amphibian parts from reptile faeces (e.g. Fitch, 1965). Frogs probably represent the largest size-class of prey which the juvenile lizards are able to consume, accounting for about 20% of the lizards' body mass. In lizards that had recently consumed amphibians the hind legs of the prey were observed protruding from the oesophagus into the mouth. That both dissected animals contained pieces of shell suggests that snails may constitute a common dietary item that is not detected in stomach flushings or faecal samples. However, it is possible that the snail shells had been lodged in the guts for some time. In both animals the fragments were found in the stomach, were perfectly clean and may have been too big to move into the small intestine.

Whereas juvenile *V. bengalensis* are entirely insectivorous (Auffenberg, 1994), the diet of juvenile *V. exanthematicus* also includes amphibians and snails. My results suggest that juvenile *V. exanthematicus* consume fewer but relatively larger prey than do juvenile *V. bengalensis*. The 92 juveniles examined by Auffenberg (1994) contained a total of 1,102 prey items, averaging nearly 12 per lizard. My data for *V. exanthematicus*, combining mean prey numbers in stomach flushings and faecal samples, suggest an average of about six prey items per lizard. Auffenberg (1994) reported a mean prey mass of 0.3 g for *V. bengalensis* of all age classes and a mean prey:predator mass ratio of 0.02 for juveniles (maximum ratio = 0.5). Although comparable figures cannot be calculated for *V. exanthematicus* from the available data, average prey mass was certainly greater than 1 g, and mean prey:predator mass ratio was not less than 0.05. For some lizards the ratio was higher than 0.3.

The only previous study of the diet of *V. exanthematicus* (Cisse, 1972) examined 28 animals, mainly adults, collected over a year in Senegal. Cisse did not find *Brachytrupes* in the diet and recorded only a single snail. Overall, orthopterans accounted for only 8.8% of prey items in Senegal, occurring in 35.7% of lizards. Coleopterans, myriapods and lepidopterans were the most important prey. Coleopterans were common in the diet in early winter and were replaced by orthopterans later in the season. Cisse (1972) stated (my translation) that *V. exanthematicus* finds its prey by active searching, with the eyes playing an essential role. My observations suggest that, other than locusts, all important food types of juvenile *V. exanthematicus* in my study area were nocturnal species that spend the day below ground. Therefore olfaction, rather than eyesight, may play the major role in prey location in this population.

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