Size and morphology of *Anolis oculatus* along an elevation gradient at selected areas of Dominica

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Abstract

Size and morphological characteristics of *Anolis oculatus* was analyzed at low and mid elevations in Western Dominica. These characteristics were plotted along an altitude gradient, indicating an inverse relationship between size and altitude. An inverse relationship was also found between head width and tail length, probably due to increased head size late in adult development. The approach proved to be effective, though morphology was not as strongly variable as predicted.

Introduction

Anolis oculatus is the only species of anole on the island of Dominica, but it exhibits a wide range of colors, sizes and morphologies. Generally, the anole is 10-20 cm in total length with brownish or greenish gray skin, sometimes spotted, and can be found on the ground or in low areas of trees. It has been shown that size and morphology have statistical trends among different ecosystems, with anoles from dry forest, primary rainforest and secondary rainforest varying in head and tail sizes proportional to overall body size (Valentine 2002). The influence of elevation upon these factors was analyzed in this study.

Materials and methods

Anoles were hunted at various times of the day and night over a period of two and a half weeks beginning 31 May 2004. The anoles were found primarily at eye level (about 1.75 meters) and below on leaves, tree trunks, leaf litter, rocks, and soil and were captured by hand. In-hand measurements were taken of snout-to-tail length, snout-to-vent length, head length, head width, jaw length, forelimb length, hind limb length, and mass. Altitude, temperature and microhabitat were also recorded for analysis.

Measurements

Snout-to-vent length was measured as total distance from tip of snout to tip of tail on the outstretched specimen. Snout-to-vent length was taken as distance from tip of snout to the back of the hind limb where it joins the body. Head length was taken as distance from tip of snout to the indention behind the tympanum. Head width was measured as the distance across the widest point of the head. Jaw length was taken as the distance from tip of snout to the backmost visible point along the mouth slit. Forelimb and hind limb lengths were measured as the distance from the tip of the longest phalange to the body with the limb outstretched yet relaxed. Mass was taken by placing the specimen in a 3g plastic zipper bag and suspending from a 100g hanging scale. Altitude was measured with a handheld altimeter calibrated to 315 m at the Springfield Station veranda.

Site Description

Four sites used for the majority of sampling were Mount Joy, Emerald Pool, Cabrits, and Batalie Beach and account for 90% of the specimens. Mount Joy is a secondary rain forest ranging in altitude of 300-500 m. Emerald Pool is primary rainforest with altitude ranging approximately 300-400 m. Cabrits is a low-lying dry forest with altitude mostly below 30 m. Batalie Beach is a very low dry forest area with altitude less than 10 m. Several samples were taken randomly at Springfield Station, Middleham Falls and Rodney's Rock, accounting for only 10% of the specimens.

Results

Factor Analysis

	Mean	Std. Deviation	Analysis N
TAIL	92.00	21.279	50
snout-vent	53.42	10.008	50
head length	17.22	3.587	50
head width	9.52	1.992	50
jaw length	11.74	2.609	50
FORELIMB	24.50	5.019	50
hind limb	40.90	7.327	50
WEIGHT	5.192	3.2205	50

Table 1 – Descriptive statistics of eight measured factors for *Anolis oculatus.*

Component	Initial Eigenvalues Total	% of Variance	Cumulative %	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %
1	6.589	82.358	82.358	6.589	82.358	82.358
2	.655	8.191	90.549	.655	8.191	90.549
3	.282	3.521	94.070			
4	.153	1.911	95.981			
5	.123	1.541	97.522			
6	9.845E-02	1.231	98.753			
7	6.770E-02	.846	99.599			
8	3.207E-02	.401	100.000			

Table 2 – Total variance explained by principle component analysis for *Anolis oculatus.*

Component Matrix

	Component 1	2
TAIL	.634	.769
snout-vent	.974	-4.775E-02
head length	.921	-.203
head width	.904	-9.038E-02
jaw length	.932	-1.838E-03
FORELIMB	.927	-8.845E-02
hind limb	.957	-6.670E-02
WEIGHT	.963	-2.567E-02

Table 3 - Component matrix for *Anolis oculatus.* Component 1, size, was consistently positive for all factors. Component 2, shape, had positive variation for tail and negative variation for head length.

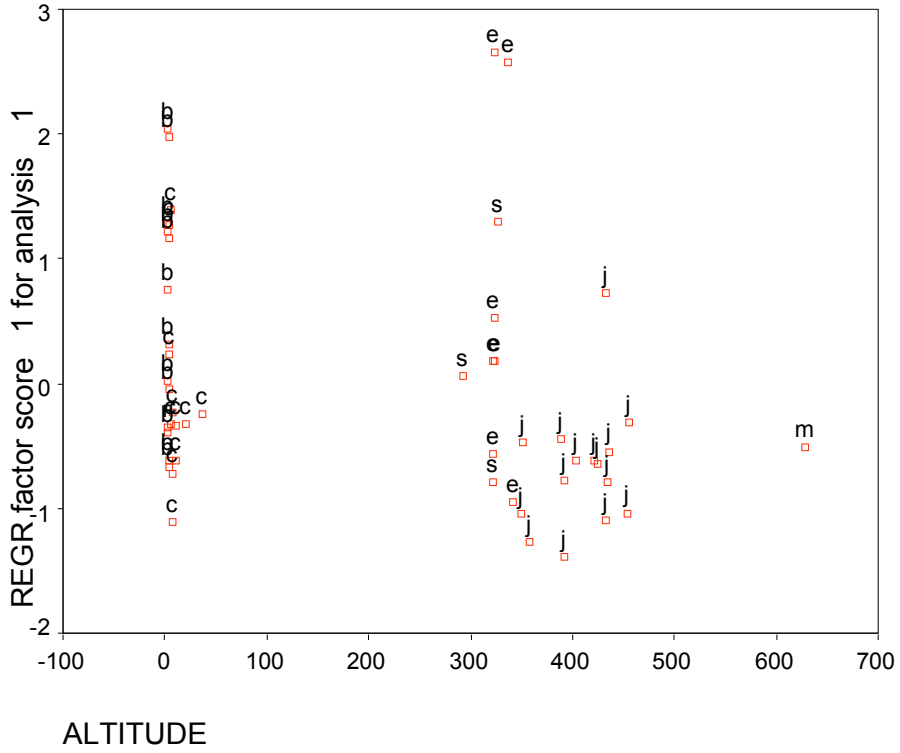

Figure 1 – Plot of *Anolis oculatus* size against altitude. Some correlation can be see between size and altitude.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.071	1	4.071	4.349	.042
	Residual	44.929	48	.936		
	Total	49.000	49			

Table 4 – ANOVA regression of size on altitude for *Anolis oculatus.* Predictors: (Constant), ALTITUDE. Dependent Variable: REGR factor score 1 for analysis 1.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.297	.198		1.504	.139
	ALTITUDE	-1.463E-03	.001	-.288	-2.086	.042

Table 5 – Coefficient regression of size on altitude for *Anolis oculatus.* Dependent Variable: REGR factor score 1 for analysis 1.

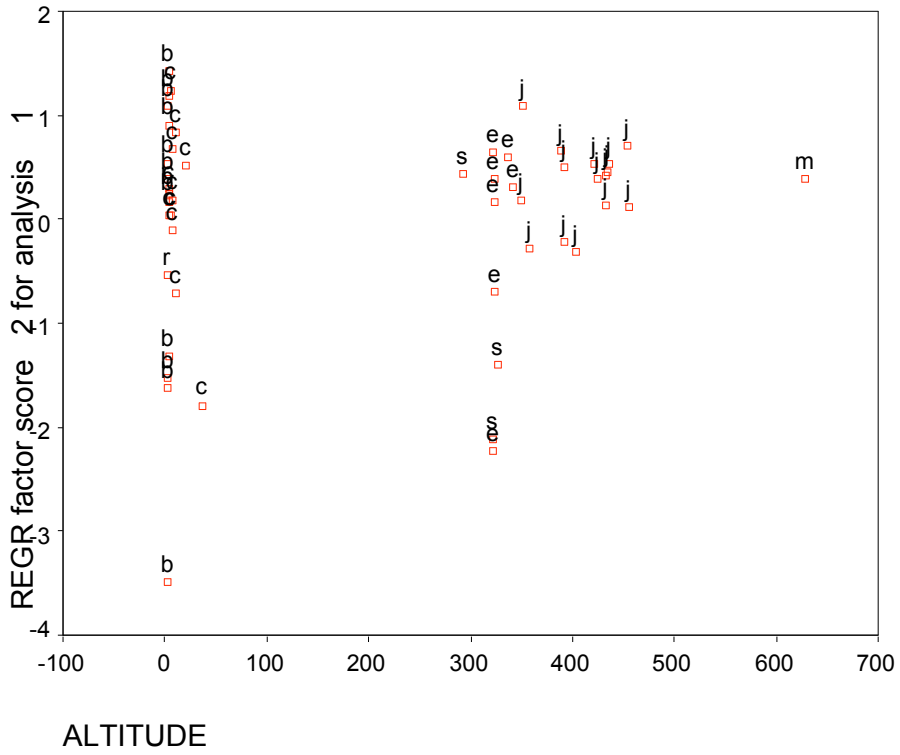

Figure 2 – Plot of *Anolis oculatus* shape against altitude. Shape does not have a strong correlation with altitude.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.461	1	.461	.456	.503
	Residual	48.539	48	1.011		
	Total	49.000	49			

Table 6 – ANOVA regression of shape on altitude for *Anolis oculatus.* Predictors: (Constant), ALTITUDE. Dependent Variable: REGR factor score 2 for analysis 1.

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-.100	.205		-.487	.628
	ALTITUDE	4.925E-04	.001	.097	.675	.503

Table 7 – Coefficient regression of shape on altitude for *Anolis oculatus.* Dependent Variable: REGR factor score 2 for analysis 1.

Discussion

Morphological relationships

Two principle components accounted for 90% of the variation in the anoles sampled. The first component was clearly size as there was a strong positive variance for all factors. This simply reflects that all body measurements generally increased as the overall size increased. The second

component reflected some variation in shape where head length was negatively varied and tail length was positively varied. The most likely reason for this relationship may be continued growth in tail length where head length development has slowed or stopped.

Size versus altitude

A strong inverse relationship existed between size of anoles and the altitude at which they were found. Increased predation at the lower dry forests may select for larger, faster anoles because of the more open, less brushy ground. Alternative causes of the size gradient may be the available diet or other environmental factors. More extensive research would be required to form a reasonable hypothesis.

Effectiveness of technique

Catching anoles by hand was a very simple and straightforward approach to sampling, but required quick reflexes and a stealthy attack. Working with a partner was of tremendous benefit when taking and recording measurements. More consistent guidelines for measurement may increase the accuracy of the data.

References

Valentine, L. 2002. *Morphological variation in Anolis oculatus between Dominican habitats.* Study Abroad Dominica, Texas A&M University.