Microclimate Regulation of *Anolis* *oculatus* on the Island of Dominica

By Justin Girdler

Abstract: *Anolis oculatus*, a Lacertilian of Dominica, regulates is body through poikilothermy. This trait makes their body temperature susceptible to environmental temperature. In order to regulate their body temperature, they either change their location to allow the environmental temperature to change them, or they change their behavior, such as elevating their body to allow for airflow. The two however are hypothetically related since their behavior causes them to relocate and settle down in a microclimate that better maintains their desired body temperature. So how does their behavior affect where they occur?

Fifty anoles were collected and measured with a quick-read, cloacal thermometer. All of them showed a positive correlation to both their microclimate temperature and a nearby microclimate selected at random. Because of the strong relationship to both, and not favoring one over the other, anoles are most affected by the ambient temperature, and are therefore not able to alter their body temperature by choosing one microclimate over another.

Introduction: On the island of Dominica, in the Lesser Antilles, there exists only one species of Anolis lizard, Anolis oculatus. While several subspecies could debatably be distinguished based on morphology and region, daily temperature control is a general concern, for all of them. Anoles are dependant on their climates to assist in regulation of their body temperatures. They adjust microclimates (immediate areas of location) and their behavior to assist in this regulation, trying to stay warm in the cold air, and cool in the hot air. Since temperatures vary throughout the day, their behavior and location differs throughout the day to compensate.

Materials and Methods: Using capture and release methods, *Anolis oculatus* were collected at varying times of the day, and their body temperatures (tb) were taken with a 10-50 degree Centigrade, quick-read, cloacal thermometer (Miller and Weber Company). Next, Total Body Length (cm) was measured from tip of nose to tip of tail (Snout - Tail) with a 30cm ruler. Torso length (cm) was also measured from snout to cloacal vent (Snout - Vent). Weight was measured last, using a Pesola 100 g Spring Balance. After the anole was released, the temperature of the microclimate (mc) where the anole was captured was measured (°C), followed by the temperature of a randomly selected microclimate (rm) 5 paces away. Random direction was determined by throwing a pencil and pacing off in the direction it pointed. Altitude (alt) was taken with a hand-held altimeter.

Results:

TABLE 1

Anole #	Time	Date	tb	mc	r	Snout-Tail	Snout-Vent	wt	alt	Location	Substrate	Details
1	2104	30-May	25	25	24.4	14.0	4.5			Bee House	Leaf	
2	1042	31-May	26.2	23.8	23.2	13.8	4.7	2.9		Middleham trail	Trunk	
3	1800	31-May	26.4	26.3	25.2	13.8	6.7	9.8	327	Stream House	Concrete	Under Refrigarator
4		2-Jun	29	27	28	14.5	5.2		3	Batalie Beach	Trunk	Large
5		2-Jun	28.8	27.4	27.2	16.9	5.8		3	Batalie Beach	Trunk	32 cm wide
6	1103	4-Jun	26.8	23.8	24.4	17.0	5.4			Mount Joy	Leaf Litter	
7	906	5-Jun	23	22.2	22.4	15.1	5.0	3.9	351	Bee House	Leaf	7.5 cm wide
8	2125	5-Jun	26	25.2	25.6	10.9	3.9	1.7	358	Bee House	Leaf	7 cm wide
9	2156	5-Jun	22.9	23.2	22	14.5	5.0	4.0	388	Burned Dorms	Leaf	4.9 by 12 cm wide
10	2207	5-Jun	26.6	22.8	22.1	13.4	4.5	2.8	392	Burned Dorms	Branch	2 cm wide
11	2215	5-Jun	25.2	22	22.6	10.7	3.6	1.9	392	Burned Dorms	Branch	9 cm wide

12	1647	6-Jun	30	29.2	28.8	13.5	5.2	4.8	4	Batalie Beach	Trunk	Large
13	1707	6-Jun	32	29.8	29.2	19.4	6.5	9.6	4	Batalie Beach	Trunk	23.4 cm wide
14	1718	6-Jun	30.6	26.8	28.3	13.0	5.9	6.1	4	Batalie Beach	Leaf Litter	
15	1725	6-Jun	28.9	26.6	26.6	21.0	7.5	13.9	4	Batalie Beach	Trunk	24.2 cm wide
16	1732	6-Jun	29.8	28.2	28.2	13.3	4.9	3.7	4	Batalie Beach	Leaf Litter	
17	1740	6-Jun	31	32.6	29.6	16.0	5.4	5.0	4	Batalie Beach	Rock	On Ground
18	1746	6-Jun	29	28.4	28.2	11.7	6.5	8.8	3	Batalie Beach	Trunk	12 cm wide
19	1807	6-Jun	29	28	27	19.4	6.5	8.8	3	Batalie Beach	Trunk	21.5 cm wide
20	1815	6-Jun	28.3	27.7	27.8	16.7	7.3	14	3	Batalie Beach	Trunk	Large
21	1821	6-Jun	27.8	26.6	26.8	12.3	5.7	5.0	3	Batalie Beach	Rock	On ground
22	1957	6-Jun	28.2	26.6	26.5	17.1	5.9	5.8	3	Batalie Beach	Leaf	6 by 18 cm wide
23	2006	6-Jun	27.2	26.6	26.4	14.4	4.7	3.7	3	Batalie Beach	Leaf	12 by 63 cm wide
24	1114	7-Jun	28.6	27.2	27	16.2	6.0		1000	Horseback Ridge	Trunk	11.3 cm wide
25	1125	7-Jun	29.1	29	27	14.4	5.5		1000	Horseback Ridge	Branch	5 cm wide
26	1605	7-Jun	24.4	23.6	23.5	17.9	5.8			Emerald Pool	Rock	Near River
27	1615	7-Jun	24.3	24.3	24	15.1	5.3			Emerald Pool	Ground	Under Roots
28	1725	9-Jun	24.6	24.2	24.8	11.7	4.1	4.2	327	Stream House	Concrete	Wall
29	915	11-Jun	26	24	23.8	12.7	4.0	2.0	342	Emerald Pool	Branch	Vine 4 cm wide
30	941	11-Jun	24.8	24.2	23.8	21.4	7.7	12.8	337	Emerald Pool	Trunk	25 cm wide
31	1051	11-Jun	25.2	24.8	24.2	13.9	5.8	5.8	324	Emerald Pool	Ground	Vertical Dirt
32	1058	11-Jun	26.2	24.7	24.1	9.9	5.0	3.3	322	Emerald Pool	Ground	Vertical Dirt
33	1111	11-Jun	24.9	24	24	16.0	5.4	4.9	322	Emerald Pool	Ground	Vertical Dirt
34	1118	11-Jun	25	24.2	23.6	16.0	5.8	6.9	323	Emerald Pool	Rock	Near River
35	1122	11-Jun	24.9	23.8	24.2	21.0	7.7	13.5	323	Emerald Pool	Rock	Near River
36	2117	12-Jun	23.4	23.6	23.2	14.0	4.9	2.6	425	Mount Joy	Leaf	26.5 by 14 cm wide
37	2127	12-Jun	28.8	24.6	23.6	12.2	4.2	1.8	433	Mount Joy	Leaf	18 by 10 cm wide
38	2136	12-Jun	24.4	24.2	23.6	16.7	5.8	5.5	433	Mount Joy	Leaf	25 by 13 cm wide
39	2141	12-Jun	23.4	23.7	23.6	12.6	4.7		433	Mount Joy	Leaf	25 by 32 cm wide
40	2218	12-Jun	24.4	24	23.6	14.0	4.8	3.0	422	Mount Joy	Leaf	26 by 12 cm wide
41	1222	13-Jun	32	29.4	29.2	16.0	5.6	5.4	5	Cabritz	Rock	
42	1227	13-Jun	29.2	29	29	17.6	6.4	7.9	5	Cabritz	Rock	
43	1234	13-Jun	29.2	29	28.8	20.2	6.9	8.8	6	Cabritz	Rock	
44	1239	13-Jun	29.6	28.8	28.6	13.9	5.0	3.5	6	Cabritz	Trunk	Large
45	1245	13-Jun	29.2	28.5	28.4	14.1	4.9	3.0	8	Cabritz	Trunk	25 cm wide
46	1252	13-Jun	29.6	28	28.2	11.7	4.3	3.0	8	Cabritz	Leaf Litter	
47	1258	13-Jun	28.4	27	27.6	14.4	5.2	4.0	8	Cabritz	Trunk	11 cm wide
48	1304	13-Jun	28.9	27.4	27.6	15.3	5.2	4.6	10	Cabritz	Rock	
49	1311	13-Jun	29	28.2	28	12.2	5.1	3.9	10	Cabritz	Rock	
50	1318	13-Jun	30	28.2	28.6	14.9	5.3	4.0	21	Cabritz	Rock	

Table 1 is a listing of all the collected data from each specimen.

In order to interpret all the data, SPSS Data Editor drew up several bivarate comparisons:

Figure 1 - A strong relationship between Body Temperature (TB) and Microclimate of .886**.**

Correlations

		TB	Microclimate
TB	Pearson Correlation	1	.886**
	Sig. (2-tailed)	.	.000
	N	50	50
Microclimate	Pearson Correlation	.886**	1
	Sig. (2-tailed)	.000	.
	N	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 2 - A strong relationship between Body Temperature (TB) and a Random microclimate of .904**.**

Correlations

		TB	RANDOM
TB	Pearson Correlation	1	.904**
	Sig. (2-tailed)	.	.000
	N	50	50
RANDOM	Pearson Correlation	.904**	1
	Sig. (2-tailed)	.000	.
	N	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 3 – Correlation between Body Temperature (TB) and Snout to Vent length is not significant**.**

Correlations

		TB	Snout-Vent
TB	Pearson Correlation	1	.196
	Sig. (2-tailed)	.	.173
	N	50	50
Snout-Vent	Pearson Correlation	.196	1
	Sig. (2-tailed)	.173	.
	N	50	50

Figure 4 – Correlation between Body Temperature (TB) and Weight is not significant**.**

Correlations

		TB	WEIGHT
TB	Pearson Correlation	1	.123
	Sig. (2-tailed)	.	.443
	N	50	41
WEIGHT	Pearson Correlation	.123	1
	Sig. (2-tailed)	.443	.
	N	41	41

These values indicate generally weak relationships. The microclimate where the anoles were captured and the random microclimates have a strong correlation with body temperature (Figures 1 and 2). Body mass, measured in length and weight shows no correlation to body temperature (Figures 3 and 4).

Discussion: Due to the positive correlation of both microclimate temperatures and body temperature, the only assumption is that specific body temperature is more strongly affected by ambient temperature than by specific microclimates' temperatures.

There are several generalities in the data set. Most anoles (all but 3) were warmer than the microclimate where they were collected from. This would be due to heat from the handler warming the anole before a measurement of its body temperature could be taken. Another possibility is that *Anolis oculatus* can conserve heat enough to stay up to a few degrees warmer than the rest of the environment. The true source however, is unknown.

Snout to vent length and weight are strongly positively correlated. Both are indicators of mass and the data seem redundant. However it was beneficial to collect both of them, as one might have produced a more meaningful relationship than the other. Measuring the snout to tail was advised, but a relationship was most unlikely since *Anolis* are able to voluntarily detach their tails and regenerate them; especially, but not exclusively at an immature age. This ability would confound interpretation of the data, since tail length does not determine age, size, or mass.

Conclusion: Original thoughts on this project had been to look at *Anolis* microclimate from an inter-specific comparison. Optimistically it would have been beneficial to have two or more species other than *Anolis*, this was not possible. Several options had been iguanas, geckos, and ameivas. Unfortunately, iguanas are too few and too hard to catch in trees; geckos are nocturnal, adding to the difficulty in capture; and ameivas would take a great deal of work to herd into a trap, and chasing them would add to loss of data in microclimate usage.

Changes were added to isolate anoles as the only subject under observation. This required more specimens, approximately 50 for a comparison that would compensate for errors. It also required more data to compare between various Anoles. Details of the surrounding environment, such as perch length and width, substrate and location were measured (Table 1) though it is not clear how to account for them. Temperature of not just the lizard and substrate, but temperature of air surrounding lizard and multiple random sites would have made for a more effective collection of data and comparisons. Noting whether the lizard was basking in sun or hiding in the shade would be relevant information in assessing the relationship between substrate and body temperature.

A better comparison of behavior versus temperature would have been to collect several lizards to mark how they react under varying temperatures. One proposition would be to cool or heat lizards to tb ranging from 20 – 30 degrees Centigrade and racing them along a 2 meter stretch, timing them to see how fast they could move. Ideally this would work better using only one individual lizard, because one would expect it to react the same in each case. It might be best to race around 20 lizards, marking their body mass (in “snout to vent” and “weight”), and posterior leg length. Perhaps racing in shade and in full sun would show a difference in performance. This could demonstrate whether temperature influences behavior and thus influences choice in habitat of *Anolis oculatus*.

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