Territorial Behavior in *Anolis oculatus* and *Anolis cristatellus*

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Abstract

Anolis oculatus or the Tree Lizard (known locally as Zanndoli) is an anole species endemic to the island of Dominica. Male *A. oculatus* can often be observed displaying their yellow-orange dewlap (throat fan) and bobbing their heads in order to defend their territory from other males. The invasive *A. cristatellus* is much more aggressive than the native Zanndoli. In order to observe the territorial behavior exhibited by male *A. oculatus* and *A. cristatellus* I created a mesh enclosure eight feet in length which I could use to observe them. The data did not strongly support any conclusions regarding territory size or duration of territorial display. However, larger males appear to be more dominant and *A. cristatellus* does interact in a territorial manner with the native *A. oculatus.*

Introduction

Dominica is often referred to as "The Nature Island of the Caribbean" because it has remained largely unchanged by human habitation. Additionally, the island is home to an abundance of tropical wildlife and several endemic species. One of these endemics is *A. oculatus* which is perhaps the most commonly encountered of Dominica's endemic species (Ferrara 2003). *A. oculatus* is a diurnal species of anole which lives mostly in trees and leads a very sedentary life; rarely leaving its own territory (usually part of the trunk of a tree.) *A. oculatus* are modest in size with an average snout to vent length (SVL) of 5-8 centimeters with a tail at least as long. Males are generally larger and possess more colorful markings than females. Additionally, males may be seen displaying an orange dewlap which the females lack (James 2004). It is well documented that *A. oculatus* coloration varies as a response to habitat throughout Dominica. Populations are also much denser in certain habitats such as dry forest and

littoral woodland (Evans and James 1997). Recently, the introduction of *A. cristatellus*, commonly known as the Puerto Rican Crested Anole, has caused some concern among biologists and worried locals. Being a very aggressive and highly adaptable species, many fear it will out-compete the native *A. oculatus* (Reinhart 2010).

My goal was to capture male *A. oculatus* and observe any territorial behavior which they exhibited. I also wished to compare interspecies territoriality between *A. oculatus and A. cristatellus.* I hoped to answer questions about territory size, duration of territorial display, and size/dominance relationships.

Materials/Methods

First, I constructed a rectangular enclosure out of 2”x2” lumber. The finished enclosure measured 8’x12”x8”. Next, I wrapped the enclosure in fine mesh fishing net, using zip ties to attach the netting to the wooden frame. I also suspended a piece of bamboo, marked w/ tape every foot in the center of the enclosure. Lastly, I installed Velcro hatches on either end so that the anoles could be introduced on opposite ends of the enclosure simultaneously. The finished enclosure is pictured below.

I kept only mature males for testing. Males were identified by their more vivid color patterns and fully formed dewlaps, while mature males were defined as those exceeding five centimeters in SVL. Before introducing the anoles to the enclosure, SVL was recorded for each individual using a dial caliper. I started a timer when the anoles were introduced to the enclosure and recorded when and where the first sign of aggression occurred (i.e. dewlap display, head bobbing, posturing.) I subsequently recorded when aggressive behavior concluded, and which male fled or submitted. Additionally, all territorial behavior was recorded and time was marked.

Results

I ran a total of six tests; five on intraspecies territoriality among *A. oculatus* with a sixth test on interspecies territoriality between *A. oculatus* and the invasive *A. cristatellus*. Figure 1 summarizes the results of the six tests. "Distance at First Display" was defined as the distance between the two males at which the first sign of aggression was observed (i.e. dewlap display, head bobbing, tail wagging, or posturing.) "Duration of Display" was defined as the time between first display and a full retreat. Finally, the loser was defined as the male which retreated first; meaning the victor was the remaining male.

Date/Time	Capture Location	Distance at First Display	Duration of Display	SVL Left	SVL Right	Victor
May 26, 11:30	Springfield	1'	20:30-43:48 23min 18sec	6.3cm	5.2cm	Left
May 28, 4:30	Batalie Beach	8"	13:31-28:37 15min 6sec	6.8cm	7cm	Left
May 28, 5:15	Batalie Beach	6'	6:44-47:45 39min 1sec	7.1cm	7.8cm	Right
May 29, 3:00	Batalie Beach	Failed Test, both males appeared more concerned with escape and failed to address the other's presence				
May 31, 2:45	Emerald Pool	2'6"	11:18-21:50 10min 32sec	7.4cm	8.2cm	Right
June 1, 3:15	Emerald Pool	3'8"	14:08-17:31 3min 23sec	5.8cm cristatellus	7.4cm anolis	Right

Figure 1: Results of the six experiments performed on anole territoriality.

Figure 2 summarizes my observations from test one. The larger male initiated the confrontation however the smaller male was more active. Ultimately, the smaller male was the first to flee.

May 26, 11:30am

6.3cm SVL, *oculatus*		**5.2cm SVL,** *oculatus*	
20:30	Minor head bobbing at 1' initiated by larger male, partial dewlap		
		24:00	Posturing to appear larger (arched back)
28:17	Head bobbing		
		33:58	Posturing
		37:31	Posturing
37:31	Head bobbing		
		43:58	Retreat

Figure 2: Observations from Test #1

Figure 3 summarizes my observations from test two. In test two the anoles were very similar in size. The smaller male initiated the confrontation but both males were equally active. The larger male retreated first, however both males eventually retreated.

May 28, 4:30pm

7.0 SVL, *oculatus*		**6.8 SVL,** *oculatus*	
		13:31	Tail wagging at 8"
20:15	Head bobbing		
		21:30	Tail wagging
		24:18	Posturing
26:07	Partial retreat		
26:30	Dewlap display		
26:50	Further retreat		
		28:16	Partial retreat
28:37 Full simultaneous retreat			

Figure 3: Observations from Test #2

Figure 4 summarizes my observations from test three. The smaller male initiated the confrontation and was by far the most active. However, the smaller male was also the first to retreat.

May 28, 5:15pm

7.1cm SVL, *oculatus*		**7.8cm SVL,** *oculatus*
6:44	Dewlap display	Remained motionless throughout duration of test, moving only his head in order to keep an eye on the opposing male.
12:53	Dewlap display	
18:48	Dewlap display	
19:50-22:20	Dewlap display, head bobbing	
25:17	Dewlap display	
32:07-35:45	Dewlap display, head bobbing	
38:00	Dewlap display	
41:00	Dismount bamboo followed by immediate dewlap display	
44:10	Partial retreat	
47:45	Full retreat	

Figure 4: Observations on Test #3

Figure 5 summarizes my observations from test four. Both males focused solely on escaping, presumably because they had been kept in captivity for over 24 hours prior to the test.

May 29, 3:00pm

7.8cm SVL, Anolis		**6.8cm SVL, Anolis**	
		2:15	Smaller male initially more concerned w/ escape. Does not appear to be aware of other male.
6:23	Larger male begins searching for means of escape.		
Test called at 30:00, neither male appears to acknowledge the presence of the opposing male.			

Figure 5: Observations on Test #4

Figure 6 summarizes my observations from test five. The smaller male initiated the confrontation and was also the most active. However, the smaller male was also the first to retreat.

May 31, 2:45pm

7.4cm SVL, Anolis		**8.2cm SVL, Anolis**	
11:18	Tail wagging at 2’6”		
13:45	Tail wagging, posturing		
		15:20	Head bobbing
		15:45	Dewlap display
17:19	Dewlap display		
18:25	Head bobbing		
19:20	Dewlap display		
21:50	Full retreat		

Figure 6: Observations on Test #5

Figure 7 summarizes my observations from test six. The smaller male (cristatellus) initiated the confrontation and was by far the most active. However, the smaller male (cristatellus) was also the first to retreat.

June 1, 3:15pm

5.8cm SVL, *cristatellus*		**7.4cm,** *oculatus*	
		10:42	Advance slightly from ~5ft to 3’8”
14:08	Head bobbing at 3’8”		
14:37	Partial retreat		
15:52	Head bobbing		
17:09	Head bobbing		
17:31	Full retreat		

Figure 7: Observations on Test #6 (interspecies territoriality between *A. oculatus* and *A. cristatellus*)

Discussion

Initiation of Territorial Behavior

There appears to be some variation in territory size among *A. oculatus.* Some individuals began displaying territorial behavior at distances as great as six feet while others showed no aggression until they less than one foot from the opposing male. As a result no clear conclusions can be drawn based on the tests performed. However, one could reasonably suggest that *A.*

oculatus territories are relatively small due to their small size and relative abundance throughout the island.

Duration of Display

In tests between *A. oculatus* males, duration of display ranged from just over ten minutes to almost forty minutes. Territorial encounters were generally long and drawn out affairs, consisting of extended periods of no activity which were punctuated every so often by the occasional head bob or dewlap display. In other words, confrontations were far more analogous to a chess match than a heavy weight prize fight. All aggressive behavior appeared cautious and measured, with long periods of inactivity punctuated by modest signs of aggression. Confrontations resulting in actual physical contact were non-existent in my study and are presumably rare in nature. However, the more aggressive nature of *A. cristatellus* resulted in a much shorter duration of display. Duration of display in test six, which included the *A. cristatellus* specimen, was a scant 3 minutes and 23 seconds. It seems reasonable to assume that territorial encounters involving *A. cristatellus* are generally shorter and more likely to result in a physical confrontation. There is also speculation that A. cristatellus may feed on juvenile A. oculatus (Daniells et al 2008). These factors might partially explain why *A. oculatus* populations plummet in areas with high numbers of *A. cristatellus* such as the Roseau Botanical Gardens (Reinhart 2010).

Correlation Between Size and Dominance

The six tests conducted provide evidence to support the theory that size is a major factor in determining dominance among both *A. oculatus* and *A. cristatellus*. Of the six tests performed, the larger male was victorious in all but one test. In the one test in which the smaller male was dominant, the difference in SVL between the two specimens was negligible, at 0.2cm. In this

experiment, an advantage of 0.7cm or greater in SVL always resulted in dominance by the larger male. Additionally, the smaller males were on average much more active even though they would ultimately retreat. As shown in figure 8, smaller males exhibited twenty-two instances of territoriality while larger males exhibited only seven.

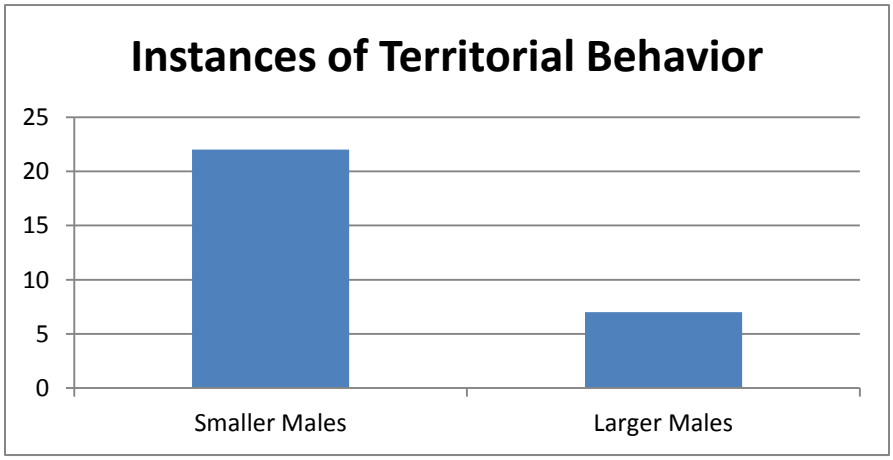

Figure 8: Comparison of instances of territoriality among male *A. oculatus* and *A. cristatellus*

It seems that the smaller males attempt to make up for their lack of size with a more aggressive demeanor, while the larger males simply rely on their physical prowess to intimidate their opponents. It should be noted that even the aggressive *A. cristatellus* submitted to a larger *A. oculatus* opponent.

Comparison of A. oculatus and A. cristatellus

The *A. cristatellus* tested largely exhibited territorial behavior similar to the pattern exhibited by *A. oculatus*. As in the tests on *A. oculatus,* the smaller *A. cristatellus* initiated the confrontation but ultimately conceded defeat. The one notable difference between the two species was duration of display. The territorial encounter was much shorter in the test conducted using *A. cristatellus,* most likely due to the species' inherent aggressive demeanor. The *A. cristatellus* specimen also appeared much more active throughout the trial; constantly fidgeting and looking around. Such behavior was non-existent among *A. oculatus* specimens.

Conclusion

There appears to be a large amount of variability in distance for initiation of territorial behavior and duration of territorial display among the anole species of Dominica. However, there appears to be a very a clear relationship between size, territorial behavior, and ultimately dominance. The limited research into the territorial behavior of *A. cristatellus* indicates that though it is a more aggressive species, it too conforms to this relationship. My experiment was limited by several factors. Firstly, it was difficult to capture an adequate number of mature males to perform a sufficient analysis. I would have preferred to run ten or more tests but simply could not collect enough specimens. Secondly, there is always a concern that behavior is altered when animals are observed in captivity. Logistically speaking, studying the anoles in captivity was the most viable option; however observation in the field would be valuable. Lastly, several aspects of my experiment deserve further study. Firstly, I believe introducing a female into the experiment might lead to intriguing results. Lastly, the interspecies territoriality between *A. oculatus* and *A. cristatellus* certainly warrants further investigation. Though I observed one confrontation between two species, I believe an entire experiment could be devoted to this topic.

Works Cited

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