Amphibia-Reptilia

Antipredation behavior covaries with body size in neotropical snakes

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Abstract. The use of defensive behaviors to avoid predation increases the likelihood of survival. Snake species have evolved numerous and diverse antipredatory behaviors to fit a variety of natural histories. Understanding how snakes react to simulated predation events can help us understand their ecology. I conducted behavioral trials on 11 colubrid and dipsadid species (n = 16 individuals) in the Republic of Panama to examine patterns of antipredation behavior. The level of aggression and number of antipredatory behaviors exhibited during simulated predation was positively correlated with body size. To complement these results, data from previously published studies were used to assess these patterns with a larger sample of Neotropical colubrids and dipsadids (n = 44 species). Indeed, the level of aggression and number of antipredatory behaviors known for each species was positively correlated with body size. However, the positive association between the number of antipredatory behaviors known for a species and body size was driven largely by colubrids and not dipsadids. Larger snakes may be more intimidating to potential predators, therefore making aggressive defensive behaviors more likely to be successful. Larger snakes also may encounter a higher diversity of predators and may benefit from the ability to choose from a suite of defensive behaviors specific to certain contexts. Although this study suggests two interesting patterns in the defensive behaviors of Neotropical colubrids and dipsadids, comparative studies of the interactions between snakes and their predators are needed to better understand the pressures driving variation in snake antipredation behavior.

Keywords: aggression, antipredatory, behavior count, Colubridae, defense, Dipsadidae.

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Supplementary material

Table S1. Antipredator behaviors of colubrid and dipsadid species listed in Martins (1996) and Martins and Oliveira (1998). Total-body lengths were obtained from Martins and Oliveira (1998). Behaviors are denoted by the following abbreviations: I = immobility; LE = locomotor escape; RB = rotate body; TB = tail break; HH = hide head; FB = form ball; C = constrict; CB = coil body; BT = body thrashing while captured; TD = tail display; IB = inflate body; RC = rub cloaca; DVBC = dorsoventral body compression; GI = gular inflation; HE = head enlargement; FD = frontal display; P = press with tail spine; CD = cloacal discharge; EH = evert hemipenes; TV = tail vibration; HE = head enlargement; SC = S-coil; G = gape the mouth in a threatening manner; H = hiss; FS = false strike; S = strike; and B = actual bite. Table sorted by total-body length (TBL). Behaviors are listed in order of increasing aggression. Taxonomic notes: *Philodryas argentea* was previously known as *Xenoxybelis argenteus*; *Erythrolamprus breviceps* was previously known as *Liophis breviceps*; *Erythrolamprus typhlus* was previously known as *Liophis typhlus*; *Erythrolamprus reginae* was previously known as *Liophis reginae*.

Species	TBL (mm)	Antipredator Behaviors																									Behavior Count	Maximum Aggression
		I	LE	RB	TB	HH	FB	C	CB	BT	TD	IB	RC	DVBC	GI	CD	FD	HE	EH	TV	SC	G	H	P	FS	S	B	
Atractus trilineatus	350		x																					x				2	4
Xenopholis scalaris	354									x				x														2	2
Atractus schach	418		x			x				x																		3	2
Tantilla melanocephala	435									x																		1	2
Atractus snethlageae	465		x			x				x																		3	2
Taeniophallus nicagus	466		x							x																		2	2
Taeniophallus brevirostris	476		x													x								x				3	4
Atractus poeppigi	503		x			x				x	x			x														5	2
Erythrolamprus breviceps	607									x																	x	2	5
Atractus latifrons	618		x							x	x			x														4	2
Atractus major	680		x			x				x																		3	2
Dipsas pavonina	741	x				x							x	x		x		x										6	2
Atractus torquatus	754		x			x				x						x												4	2
Erythrolamprus reginae	810		x							x		x		x		x											x	6	5
Drepanoides anomalus	837		x			x				x						x												4	2
Erythrolamprus typhlus	853					x				x				x		x												4	2
Erythrolamprus aesculapii	927									x	x			x					x								x	5	5

Xenodon rhabdocephalus	943													x														x	2	5
Helicops hagmanni	945			x					x																				2	2
Oxyrhopus melanogenys	1018		x						x											x									3	3
Siphlophis cervinus	1022					x			x																				2	2
Helicops angulatus	1025			x			x	x	x					x				x				x						x	8	5
Oxyrhopus formosus	1027		x						x																				2	2
Dipsas indica	1028								x							x		x											3	2
Leptodeira annulata	1038															x		x			x				x				4	4
Dendrophidion dendrophis	1183			x	x					x						x				x									5	3
Philodryas viridissima	1195								x						x		x				x	x				x	x		7	5
Pseudoboa neuwiedii	1217		x				x		x																				3	2
Imantodes cenchoa	1250	x		x					x							x			x										5	2
Drymoluber dichrous	1300			x																x									2	3
Philodryas argentea	1335	x							x							x													3	2
Siphlophis compressus	1431			x					x									x		x	x					x			6	5
Mastigodryas boddaerti	1505		x	x					x											x	x					x	x		7	5
Chironius fuscus	1597	x		x					x											x									4	3
Rhinobothryum lentiginosum	1605																	x		x									2	2
Oxybelis aeneus	2000	x		x					x							x					x	x				x	x		8	5
Oxybelis fulgidus	2160		x	x					x						x		x				x					x	x		8	5
Leptophis ahaetulla	2340								x									x			x	x			x	x	x		7	5
Pseustes poecilonotus	2400		x	x					x					x		x				x	x	x	x		x	x	x		12	5
Chironius scurrulus	2430		x	x					x					x							x					x			6	5
Spilotes pullatus	2430		x						x					x		x					x						x		6	5

Clelia clelia	2600				x									1	1
Chironius multiventris	2611	x		x		x	x	x				x	x	7	5
Pseustes sulphureus	2752	x	x	x		x	x		x	x	x	x		9	3