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Herpetofauna of Mount Roraima, Guiana Shield Region, Northeastern South America

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The Guiana region of northeastern South America is an area of high biodiversity, and the varied habitats on the tepuis of the region support a significant portion of this diversity. The zoogeography of the pantepui region has been a recent topic of interest, with several sources of published data (Duellman 1999; Gorzula and Señaris 1999; Hollowell and Reynolds 2005a; Hoogmoed 1979a; McDiarmid and Donnelly 2005).

The herpetofaunal communities of several tepuis have been described (Donnelly and Myers 1991; Gorzula 1992; McDiarmid and Paolillo 1988; Myers 1997; Myers and Donnelly 1996, 1997, 2001). Mount Roraima, the most famous of these table mountains, has been explored extensively (McDiarmid and Donnelly 2005). Although numerous specimens have been collected on Roraima, these collections have never been summarized or analyzed.

Roraima (05º12'N, 060º44'W) is one of the highest points in northeastern South America, and it marks the boundary between Guyana, Venezuela, and Brazil. The summit plateau, from 2600 to 2810 m elevation, is some 34 km^2 in area. The plateau is known for its varied rock formations, and for its very sparse vegetation. The summit is at the top of steep walls which extend from below 2000 m up to 2600–2700 m; these walls are occasionally broken by more gradual slopes. At the bottom of the vertical walls, below about 2000 m, the tepui is surrounded by forested slopes. The forest is most extensive below 1500 m, with only a narrow band encircling the mountain above this elevation. Descriptions of the physical features and vegetation of Roraima are in Huber (1995a, b).

Herpetofaunas on tepui summits often differ in species composition from faunas on tepui slopes. Summit faunas are often more depauperate than slope faunas (Myers and Donnelly 2001). Both elevation and microhabitat can affect species distributions, and many species occur over a range of elevations (McDiarmid and Donnelly 2005). It is therefore worthwhile to have a compilation of slope and summit species, for comparison with faunas on other mountains.

The first aim of this paper is to compile a list of the known herpetofauna of Roraima, from both summit and slopes. The second aim is to compare the Roraima herpetofauna with those of other tepuis in the Guiana Shield (following Hollowell and Reynolds 2005b, p.1); this consists of 1) comparison using criteria developed by McDiarmid and Donnelly (2005), and 2) the hypotheses of tepui zoogeography of Myers and Donnelly (2001), who enumerated five general points about the composition of tepui herpetofaunas. Such comparisons can provide valuable insight about the zoogeography of the region.

Methods.—Information was taken from museum records or published literature. Amphibian taxonomy follows Faivovich et al. (2005), Frost et al. (2006) and Grant et al. (2006); reptile taxonomy follows Avila-Pires (2005). Institutional abbreviations follow Leviton et al. (1985), with the following additions: CSBD – Centre for the Study of Biological Diversity, University of Guyana, Georgetown, Guyana; MHNLS – Museo de Historia Natural La Salle, Caracas, Venezuela (formerly SCNLS); ULABG – Laboratorio de Biogeografia, Universidad de Los Andes, Mérida, Venezuela.

The aims of this study require that two points be defined. First, what are the boundaries of Roraima? Second, what are highland species? These questions were resolved as follows:

Roraima: We defined the boundaries of Roraima as that part of the mountain which is above 1500 m. Although some studies of the Guiana Shield region have used 1000 m as a minimum elevation (e.g., Hoogmoed 1979a), the use of this criterion at Roraima would necessitate the inclusion of the extensive surrounding uplands, and would increase the boundaries of Roraima to an unrealistic extent. We therefore adopted the 1500 m criterion, as have other studies of the Guiana fauna (Gorzula and Señaris 1999; McDiarmid and Donnelly 2005).

Because of the potentially great difference between faunas on tepui summits and faunas on forested tepui slopes, we have indicated the location from which each species was recorded, in order to determine whether each is part of the summit or slope faunal assemblages. The habitat on the slopes of Roraima is varied, ranging from steep rocky walls to more gently sloping forested areas (Huber 1995a, b).

Highland Species: Highland species are those which typically occur above 1500 m; any such species is here considered a highland species, although it may have been occasionally collected below 1500 m. McDiarmid and Donnelly (2005) followed a similar procedure. Although a highland species may occasionally occur at elevations below 1500 m, it will not be widespread below that elevation. Table 1 contains all species reported from above 1500 m, plus several highland species collected slightly below

TABLE 1. Amphibians and reptiles collected from Mount Roraima. G = Guyana, V = Venezuela. Species marked with ([h]) are considered to be highland species, seldom occurring below 1500 m.

Family	Species	Country	Location	Latitude	Longitude	Elevation (m)	Institution	Citation
AMPHIBIA								
Aromobatidae	*Anomaloglossus praderoi* [h]	V	Third valley from base	05º10'	060º47'	1800, 1950	MHNLS, ULABG	La Marca 1997
	Anomaloglossus roraimae [h]	V	Paso de la Muerte just below summit			2700	ULABG	La Marca 1997
	Anomaloglossus roraimae [h]	G	North slope			1860–2350	USNM	Grant et al. 2006
Brachycephalidae	*Eleutherodactylus marmoratus* [h]	V	Summit Plateau			2600	UMMZ	
	Eleutherodactylus sp.	G	Summit	05º 12'	060º 44'	2600	USNM	
Bufonidae	*Oreophrynella macconnelli* [h]	G	North slope			1477–1800	BMNH	Warren 1973
	Oreophrynella quelchii [h]	V	Summit	05º 12'	060º 44'	2650	BMNH	Boulenger 1900b
	Oreophrynella quelchii [h]	V	Summit, west	05º 11'	060º 48'	2750	EBRG, MHNLS	
	Oreophrynella quelchii [h]	V	Summit	05º 12'	060º 44'		MCZ, UMMZ	Rivero 1961
	Oreophrynella quelchii [h]	V	Slope	05º 09'	060º 46'	1700	MHNLS	
	Oreophrynella quelchii [h]	G, V	Summit				USNM	
Cryptobatrachidae	*Stefania roraimae* [h]	G	North slope			1402	CSBD	Duellman and Hoogmoed 1984
Hylidae	*Hyla warreni* [h]	G	North slope	05º 17'	060º 44'	1480	BMNH, CSBD, KU	Duellman and Hoogmoed 1992
	Hypsiboas roraima [h]	G	North slope	05º 17'	060º 44'	1430–1480	BMNH, CSBD, KU	Duellman and Hoogmoed 1992
	Hypsiboas sibleszi [h]	G	North slope			1476	BMNH, CSBD	Hoogmoed 1979b
	Myersiohyla kanaima [h]	G	North slope	05º 17'	060º 45'	1430	BMNH, CSBD, KU, USNM	Duellman and Hoogmoed 1992
Leiuperidae	*Pseudopaludicola* sp. [h]	V	Slope	05º 10'	060º 47'	1550	MHNLS	
Leptodactylidae	*Leptodactylus fuscus*	V	Philipp Swamp			1570	AMNH	
Microhylidae	*Otophryne steyermarki* [h]	V	Slope	05º 10'	060º 44'	1550	MHNLS	
REPTILIA								
Gymnophthalmidae	*Arthrosaura versteegei*	V	Southeast slope	05º 11'	060º 43'	1920	MHNLS	
	Riolama leucosticta [h]	V	Summit			2700	BMNH	Boulenger 1900a
Polychrotidae	*Norops chrysolepis*	V	Slope	05º 10'	060º 45'	1920	MHNLS	
Scincidae	*Mabuya nigropunctata*	V	Slope	05º 09'	060º 47'	1550	MHNLS	
Tropiduridae	*Tropidurus hispidus*	V	Slope	05º 09'	060º 47'	1550	MHNLS	
Colubridae	*Liophis breviceps*	V	Slope	05º 10'	060º 45'	1950	MHNLS	
Viperidae	*Bothriopsis taeniata*	V	Slope	05º 09'	060º 47'	1550	MHNLS	
	Crotalus durissus	V	Slope	05º 09'	060º 47'	1550	MHNLS	

1500 m (between 1400 and 1500 m) on Roraima.

Comparisons: Not all species in Table 1 are included in that part of the Discussion concerning comparisons among tepui faunas. In order to make the comparisons as valid and accurate as possible, we used the same criteria as those used by other studies to which we compare the Roraima fauna. Two types of comparisons are made. The first is based on elevational and distributional ranges of species occurring on each mountain as defined by McDiarmid and Donnelly (2005). These authors (2005, p. 483) examined the elevational ranges (ER) and distribution patterns (DP) of tepui species. Elevation ranges and distribution patterns are weighted according to their extent, and the weighted results are added to produce two values: Sum of elevational ranges (SUMER) and Sum of distribution patterns (SUMDP), which reflect the composition of each tepui community. Only those species which occur above 1500 m are used in this comparison. The second type of comparison is based on the hypotheses of tepui herpetofaunas proposed by Myers and Donnelly (2001); only those species which fit the above definition of highland species are used in this comparison.

Results.—The search of institutional records and published literature turned up 14 amphibian and 8 reptile species in 18 genera and 13 families occurring on Roraima. These taxa are shown in Table 1. Where data such as coordinates, elevation and precise location are known, they are provided in the table.

Several changes have been made to information from the literature. These are as follows:

1) Phelps (1938) determined that the specimens collected by McConnell and Quelch, reported in Boulenger (1900a, b) as being from Guyana, were actually collected in Venezuela. Table 1 follows this determination.

2) Rivero (1961) reported two species of *Leptodactylus* from the summit of Roraima in the AMNH collection: *L. sibilatrix* AMNH 39752 and *L. podicipinus petersi* AMNH 39753. However, according to AMNH records, 39752 is *L. fuscus* from Philipp Swamp and 39753 is *L. sabanensis* from a location below 1500 m. Table 1 follows this determination.

3) Gorzula and Señaris (1999, p. 255) reported *Tepuihyla edelcae* from Roraima. However, although *T. edelcae* is reported from Roraima on p. 255, the more detailed species account (p. 49) contains no mention of its presence on Roraima. This species has been collected only from several tepuis to the west of Roraima (Auyán, Chimantá, Los Testigos). Table 1 follows this determination, as do McDiarmid and Donnelly (2005).

4) The latitude given for the north slope of Roraima in Duellman and Hoogmoed (1992) corresponds to a location some 35 km N of Roraima. Following Warren (1973) we have amended this latitude to 05º17'N.

In addition to *Norops chrysolepis*, which has also been recorded above 1500 m (Table 1), 39 additional species, *Chaunus granulosus, C. marinus, Rhinella margaritifer*, *Anomologlossus* sp., *Stefania scalae*, *Dendropsophus minutus*, *Hypsiboas boans*, *H. crepitans*, *H. multifasciatus*, *Scinax ruber*, *Adelophryne gutturosa*, *Eleutherodactylus* sp., *Leptodactylus bolivianus*, *L. pallidirostris*, *L. petersi*, *L. sabanensis*, *Otophryne robusta*, *Synapturanus* sp., *Lithobates palmipes*, *Norops auratus*, *N. fuscoauratus*, *Polychrus marmoratus*, *Mabuya nigropunctata*, *Ameiva ameiva*, *Arthrosaura guianensis*, *Cnemidophorus lemniscatus*, *Kentropyx calcarata*, *K. striata*, *Neusticurus rudis*, *Boa constrictor*, *Leptodeira annulata*, *Liophis lineatus*, *Liophis typhlus*, *Mastigodryas bifossatus*, *M. boddaerti*, *Oxybelis aeneus*, *Tantilla melanocephala*, *Micrurus lemniscatus,* and *Bothrops atrox*, were collected on the slopes of Roraima below 1500 m (Barrio 1998; Boulenger 1900a, b; Campbell and Clarke 1998; Heyer 1994; Hoogmoed 1979b; Rivero 1961).

Discussion.—Seventeen species have been collected from above 1500 m on Roraima. Numbers of species collected on Roraima are compared to collections from some other tepuis in Table 2. In order to ensure that such comparisons are as meaningful as possible, only large, frequently-visited tepuis in the eastern Guiana region are included in the table. There are few such tepuis; for this reason we include Guaiquinima, even though it does not reach 1500 m.

Roraima's diversity is lower than that on other comparable tepuis (Table 2), despite having been visited by collectors at least as often as have other tepuis. While other large tepuis have forested slopes which support considerable faunal diversity, Roraima's slopes are mostly steep rocky walls, with only a narrow forested band above 1500 m. The summit of Roraima also supports little vegetation, and its area is smaller than the summits of other tepuis (Huber 1995a). Thus, the limited amount of suitable habitat on Roraima may account for its low faunal diversity.

Faunal composition on the slopes of Roraima changes with elevation, and there is no overlap between the slope and summit faunas. The faunal changes are summarized in Table 3. Specimens have never been collected systematically along an elevational transect on the slopes of Roraima; most are from the vicinity of locations which are suitable for camping. It is possible that elevational changes in faunal composition are partly an artefact of

TABLE 2. Species diversity on frequently visited large tepuis of the eastern Guiana Shield.

Location	Elevation (m)	Number of Species Collected	Season of Visit(s)	Reference
Auyán	1600–2100	24	various	Myers 1997 McDiarmid and Donnelly 2005
Chimantá	1800–2600	18	various	Gorzula 1992 McDiarmid and Donnelly 2005
Guaiquinima	1030–1380	21	February–April	Donnelly and Myers 1991 Gorzula and Señaris 1999
Roraima	1500–2810	17	various	Table 1, this paper

TABLE 3. Elevational distribution of families on Mount Roraima.

Family	> 1500 m	Summit
Aromobatidae	2	0
Brachycephalidae	2	2
Bufonidae	2	1
Leptodactylidae	2	0
Microhylidae	1	0
Gymnophthalmidae	2	1
Polychrotidae	1	0
Scincidae	1	0
Tropiduridae	1	0
Colubridae	1	0
Viperidae	2	0
Total	17	4

collecting efforts. For example, the Hylidae, which are very diverse at lower elevations, are not represented above 1500 m. However, several highland species (*Hyla warreni*, *Hypsiboas roraima*, *H. sibleszi*, *Myersiohyla kanaima*, *Stefania roraimae*) were collected between 1400 and 1500 m on Roraima. All of these have been collected above 1500 m on other tepuis, and it is possible that they occur above 1500 m on Roraima as well.

Only four species (*Oreophrynella quelchii*, *Eleutherodactylus marmoratus*, *Eleutherodactylus* sp. [USNM], *Riolama leucosticta*) are known from the summit of Roraima, with *Anomaloglossus roraimae* collected from a location just below the summit. Tepui summit faunas are typically depauperate, but nonetheless this number is somewhat lower than the numbers of species collected on the summits of other frequently-visited tepuis (McDiarmid and Donnelly 2005; Myers and Donnelly 2001).

The remaining species (Table 1) were recorded from a variety of habitats on the slopes of Roraima. Some slope species have been reported only from higher elevations elsewhere, such as *Hyla warreni* (MacCulloch and Lathrop 2005), *Stefania roraimae* (MacCulloch and Lathrop 2002) and *Otophryne steyermarki* (Barrio 1999; Campbell and Clarke 1998; Myers 1997), but many reptile species have been reported from a broad range of elevations.

Some genera which have been collected in several other highland locations in the Guiana Shield (e.g., *Hyalinobatrachium*, *Tepuihyla*, *Thamnodynastes*) have not been collected on Roraima.

McDiarmid and Donnelly (2005, p. 512) listed elevation ranges for many Guiana Shield species. Table 1 increases the elevation ranges for *Oreophrynella quelchii*, *Otophryne steyermarki,* and *Tropidurus hispidus*.

Comparisons: Elevational ranges (ER) and distribution patterns (DP) of tepui species were examined by McDiarmid and Donnelly (2005). Elevational ranges and distribution patterns for the Roraima community are in Table 4; SUMER = 648 and SUMDP = 739. These values are similar to those presented by McDiarmid and Donnelly (2005) for other large tepuis. SUMER and SUMDP for Roraima, and for other tepuis, will undoubtedly change as knowledge of the fauna increases.

Myers and Donnelly (2001, p. 79) established five general statements concerning tepui herpetofaunas. The assembled data from

TABLE 4. Elevational ranges and distribution patterns for the 17 species which occur above 1500 m on Mount Roraima. Distribution patterns (from McDiarmid and Donnelly 2005): HR = highly restricted (occurs on only one tepui); MR = moderately restricted (two or more tepuis); GE = Guiana endemic; WS = widespread.

Species	Elevational Range (ER) (m)	ER Weighting Factor	Distribution Pattern (DP)	DP Weighting Factor
Anomaloglossus praderoi	1800–1950	1	HR	1
Anomaloglossus roraimae	1860–2700	2	HR	1
Eleutherodactylus marmoratus	100–2600	100	GE	10
Eleutherodactylus sp. (summit)	2600	0	HR	1
Oreophrynella macconnelli	1067–1800	2	HR	1
Oreophrynella quelchii	1700–2800	10	MR	2
Leptodactylus fuscus	100–1570	10	WS	100
Pseudopaludicola sp.	1550	0	HR	1
Otophryne steyermarki	1550–2150	2	GE	10
Arthrosaura versteegei	100–1920	100	GE	10
Riolama leucosticta	2500–2700	1	MR	2
Norops chrysolepis	100–1920	100	WS	100
Mabuya nigropunctata	100–1550	10	WS	100
Tropidurus hispidus	20–1550	10	WS	100
Liophis breviceps	100–1950	100	WS	100
Bothriopsis taeniata	0–2000	100	WS	100
Crotalus durissus	30–1920	100	WS	100
		SUMER = 648		SUMDP = 739

TABLE 5. Herpetofaunal community composition on summits of Roraima and neighboring tepuis.

Species	Roraima	Kukenán	Ilú	Yuruaní	Wei-Assipu	Citation or Institution
Anomaloglossus sp.					X	Villarreal et al. 2002
Eleutherodactylus marmoratus	X					UMMZ
Eleutherodactylus sp.	X					USNM
Eleutherodactylus sp.				X		Mägdefrau and Mägdefrau 1994
Oreophrynella nigra		X		X		Señaris et al. 1995
						Gorzula and Señaris 1999
Oreophrynella quelchii	X				X	Señaris et al. 2005
Oreophrynella vasquezi			X			Señaris et al. 1995
						Gorzula and Señaris 1999
Oreophrynella weiassipuensis					X	Señaris et al. 2005
Stefania riveroi				X		Señaris et al. 1997
						Gorzula and Señaris 1999
Stefania sp.					X	Villarreal et al. 2002
Hyla warreni					X	Villarreal et al. 2002
Tepuihyla sp.					X	Villarreal et al. 2002
Riolama leucosticta	X	X		X		Gorzula and Señaris 1999

Roraima are examined below to determine the extent to which they support these five points.

Point 1: tepuis have relatively depauperate herpetofaunas. This is true for summit faunas. The Roraima summit fauna consists of four species; the fauna on other tepui summits ranges from zero to 15 species (McDiarmid and Donnelly 2005; Myers and Donnelly 2001, see also Table 5). Herpetofaunas on the slopes of tepuis are usually more diverse.

Point 2: neighboring tepuis are likely to have significantly different faunas. Although Myers and Donnelly (2001) did not quantify the definition of neighboring tepuis, they used Auyán and Chimantá, which are 50 km apart, as examples. Therefore we use this distance as a criterion, and consider tepuis within 50 km of Roraima to be neighboring tepuis.

Four tepuis within a 50-km radius have been visited: Kukenán (05º13'N, 060º51'W, 2650 m elev.), Yuruaní (05º19'N, 060º51'W, 2300 m elev.), Ilú (05º25', 060º59'W, 2700 m elev.), and Wei-Assipu (05º13'N, 060º42'W, 2400 m elev.). Although some specimens have been collected on the slopes of Kukenán (Gorzula and Señaris 1999; Rivero 1961), collections from Ilú, Yuruaní, and Wei-Assipu were made only on the summits, accessed by helicopter (Gorzula and Señaris 1999; Villarreal et al. 2002). Therefore only the summit faunas will be used for comparison among these five tepuis (Table 5). Collections from Kukenán contained one amphibian species (*Oreophrynella nigra*) which has not been collected on Roraima. Specimens from Wei-Assipu include four species which have apparently not been collected on Roraima, although three of these are identified only to genus. The Wei-Assipu community also includes one genus (*Tepuihyla*) which has not been reported from Roraima.

The herpetofauna of Wei-Assipu is more diverse than those of the neighboring tepuis Roraima, Kukenán, Ilú, and Yuruaní. This may be because of summit habitat; on the latter four tepuis the summit is rocky and vegetation is sparse (Señaris et al. 1995, 1997), while the summit of Wei-Assipu supports more vegetation (Villarreal et al. 2002).

Only three species, *Oreophrynella nigra*, *O. quelchii,* and *Riolama leucosticta*, occur on more than one tepui. The ten remaining species are found on only one of the five, although two also occur at more distant locations (*Eleutherodactylus marmoratus* and *Hyla warreni*).

Although *Oreophrynella* are found on all five tepuis, and *Riolama* on three, other genera and even families exhibit little overlap. The summit faunas of these neighboring mountains are quite different. This situation is similar to that observed on Auyán and Chimantá (Myers 1997).

Point 3: tepui endemics outnumber widespread highland species. Expanding on the criterion established in Point 2, we consider any species from Roraima which also occurs in one or more locations more than 50 km distant from Roraima to have a widespread distribution. Using this criterion, seven of the highland species occurring on Roraima have been reported from locations at distances of 50–200 km from Roraima, and are therefore considered widespread species. These are *Stefania roraimae* (MacCulloch and Lathrop 2002), *Hyla warreni* (MacCulloch and Lathrop 2005), *Hypsiboas roraima* (MacCulloch and Lathrop 2005), *H. sibleszi* (Duellman 1997; Hoogmoed 1979b; MacCulloch and Lathrop 2005), *Myersiohyla kanaima* (Duellman and Hoogmoed 1992; Goin and Woodley 1969; MacCulloch and Lathrop 2005), *Eleutherodactylus marmoratus* (Frost 2004), and *Otophryne steyermarki* (Barrio 1999; Gorzula and Señaris 1999).

Of the four Roraima summit species, only *Eleutherodactylus* sp. (USNM) is endemic. Of the highland slope species only four (*Oreophrynella macconnelli*, *Anomaloglossus praderoi*, *Anomaloglossus roraimae*, *Pseudopaludicola* sp. [MHNLS]) have never been reported from elsewhere and can be considered endemic. On Roraima, widespread highland species outnumber endemics.

Point 4: some endemic species have counterparts on other tepuis. This point is supported by the Roraima data. The genera *Oreophrynella*, *Eleutherodactylus* and *Anomaloglossus* are good examples of this phenomenon.

Point 5: lowland species find their way onto tepuis in an irregular, unpredictable manner. This point is well supported by the Roraima data. Several lowland species, *Leptodactylus fuscus*, *Mabuya nigropunctata*, *Tropidurus hispidus*, *Liophis breviceps*, *Bothriopsis taeniata* and *Crotalus durissus*, occur above 1500 m on Roraima. Some of these species (*Leptodactylus fuscus*, *Tropidurus hispidus*, *Bothriopsis taeniata*, *Crotalus durissus*) have also been reported from high elevations elsewhere (Donnelly and Myers 1991; Gorzula and Señaris 1999; McDiarmid and Donnelly 2005; Means 2004).

The Roraima data support Points 2, 4, and 5 well, but provide little support for Points 1 and 3. Some points appear to apply more to summit faunas than to slope faunas.

The Roraima herpetofauna is a mixture of high- and low-elevation taxa, similar to the faunas on numerous other tepuis in the Guiana Shield region. Although knowledge of the region's amphibians and reptiles is far from complete, the situation will improve as more of the region is explored, and as previously collected locations are revisited.

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First Detailed Report of Predation on Anuran Metamorphs by Terrestrial Beetle Larvae

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Invertebrates are known predators of both aquatic and terrestrial stages of amphibians (reviewed in McCormick and Polis 1982; Toledo 2005). Seventy-three percent of reported predation events in and out of the water on anurans involved spiders (ca. 48%) and water bugs. The remainder included crabs, leeches, and various insect groups (Toledo 2005). A review of the published information on predation of juvenile and adult amphibians by beetles revealed reports on predation by adult carabids (Huheey and Stupka 1967; Littlejohn and Wainer 1978; Ovaska and Smith 1988; Robertson 1989; Smith 1946), dytiscids (Hinshaw and Sullivan 1990), cicindelids (McCormick and Polis 1982) and staphylinids (Jung et al. 2000).

There are three reported cases of terrestrial beetle larvae preying on amphibians, all belonging to the carabid tribe Chlaeniini (= Callistini). Shiina and Tachikawa (1988) reported how *Epomis nigricans* larvae ambush *Hyla* sp. and *Rhacophorus schlegelii* on vegetation and prey upon them (shown in photographs by Tachikawa 1994). There is a preliminary report from South Africa on carabid beetle larvae associated with *Bufo* sp. (Moore 1971). That author received two preserved first instar larvae identified as Chlaeniini, which had been found attached by means of the mandibles to the hind leg of a toad. No further information was given as to whether the described larvae were able to kill or physically harm the toad.

While studying the population dynamics of the Green Toad (*Bufo viridis*), a species that was recently declared endangered in Israel (Gafny 2004), we encountered on several occasions a carabid larva attached to Green Toad and Yellow Lemon Tree Frog (*Hyla savignyi*) metamorphs. We describe here the predation behavior and its frequency of occurrence in the central coastal plain of Israel, together with a description of the beetle's larval development and pupation.

Methods.—We monitored *Bufo viridis* breeding populations in the central coastal plain of Israel (0–50 m elevation) at seven rain pools over a period of four years (2002–2005), at two pools for two years (2002–2003), and at one pool for one year (2006). We searched seasonally for metamorphs under cover items including logs, stones and debris, along the edge and in the vicinity of the rain pools. Each site was sampled regularly every two weeks, starting in the third week of March, until no additional metamorphs were located at the site for at least two consecutive visits. All metamorphs were transferred to the laboratory for inspection of malformations or other signs of abnormality and were then returned to the collection site. Among them we found beetle larvae