SALAMANDRA	45	2	95-105	Rheinbach, 20 May 2009	ISSN 0036-3375

A new species of salamander in the *Bolitoglossa dunni* group (Caudata: Plethodontidae: Bolitoglossinae) from Parque Nacional Montaña de Yoro, Honduras

Josiah H. Townsend, J. Michael Butler, Larry David Wilson & James D. Austin

Abstract. A new species of cloud forest salamander in the *Bolitoglossa dunni* species group, subgenus *Magnadigita*, is described from the vicinity of Cataguana, Parque Nacional Montaña de Yoro, Honduras. This new taxon differs from other species in the group, as well as all other described *Bolitoglossa*, on the basis of morphological and molecular characteristics. Mitochondrial DNA sequence data indicate the new species is most closely related to *B. decora*, a species endemic to cloud forest in Parque Nacional La Muralla, Honduras.

Key words. *Magnadigita*, *Bolitoglossa decora*, Mesoamerica, cloud forest, endemic, mtDNA.

Resumen. Se describe una nueva especie de salamandra de bosque nublado perteneciente al grupo de la especie *Bolitoglossa dunni*, subgénero *Magnadigita*. La nueva especie es procedente de las cercanías de Cataguana, Parque Nacional Montaña de Yoro, Honduras. Este nuevo taxón difiere de las otras especies del grupo, y de las demás *Bolitoglossa* descritas anteriormente, en base a sus características morfológicas y moleculares. Los datos de la secuencia de ADN mitocondrial indican que la nueva especie se encuentra relacionada, mas cercanamente, a *B. decora*, una especie endémica del bosque nublado en Parque Nacional La Muralla, Honduras.

Introduction

Neotropical lungless salamanders (Caudata: Plethodontidae) are renowned for their extraordinary diversity in the highlands of Mesoamerica (Wake & Elias 1983, Wake 1987, Parra-Olea et al. 2004). Remarkably, all the neotropical plethodontids are members of a single clade (Bolitoglossinae), which has undergone repeated radiations in the highland areas from Mexico to South America (Parra-Olea et al. 2004, Wiens et al. 2007). Nuclear Central America, the ancient highlands between the Isthmus of Tehuantepec and the Nicaraguan Depression, is a region with a well-documented adaptive radiation of bolitoglossines (Wake 1987), with the genus *Bolitoglossa* accounting for the majority of salamander species-level diversity in Nuclear Central America.

The highlands of eastern Nuclear Central America (the area east and south of the Río Motagua in eastern Guatemala, El Salvador, Honduras, and northern Nicaragua) is the site of a dramatic diversification in the *Bolitoglossa dunni* species group, a group that is well-defined by both morphological and molecular synapomorphies (McCranie & Wilson 1993, Parra-Olea et al. 2004). The *B. dunni* group was placed in the subgenus *Magnadigita* by Parra-Olea et al. (2004), based on their study of the phylogenetic systematics of *Bolitoglossa*. There are currently 12 recognized species in the *B. dunni* group, and 10 of those species are endemic to the Republic of Honduras or the mountains along its borders with Guatemala and El Salvador: *B. carri*, *B. celaque*, *B. conanti*, *B. diaphora*, *B. dunni*, *B. heiroreias*, *B. longissima*, *B. oresbia*, *B. porrasorum*, and *B. synoria* (Cruz et al. 2006, McCranie & Wilson 2002, McCranie et al. 2005).

While undertaking fieldwork in the previously unsampled cloud forest of Parque Na-

cional Montaña de Yoro in June 2006, JHT and LDW collected two specimens of an unidentified salamander assignable to the *B. dunni* group. During a subsequent trip to the same locality in March 2007 by JHT, JMB, LDW, and coworkers, five additional specimens of the same *B. dunni* group salamander were collected. Evaluation of molecular and morphological affinities of this series and known species in the *B. dunni* group indicate that these specimens represent a new taxon, which we describe below.

Materials and methods

All measurements were made with a stereomicroscope using either an optical micrometer or dial calipers, with measurements rounded to the nearest 0.1 mm. Format for the new species description generally follows those presented in other recent papers describing *Bolitoglossa dunni* group species (Greenbaum 2004, McCranie et al. 2005). The diagnosis is based on data presented in other works dealing with systematics of the *B. dunni* group species (McCranie & Wilson 1993, 2002). Measurements include: snout-vent length, measured from tip of snout to posterior edge of vent (SVL); tail length (TL); head length, measured from tip of snout to gular fold (HL); head width, measured at widest point (HW); axilla-groin length (AG); trunk width, measured at widest point (TW); forelimb length (FLL); and hind-limb length (HLL). Measurements of forelimb digits follow Tilley (1981), except for Digit I, which was measured along the lateral margin of the toe following the method of Greenbaum (2004). The following abbreviations for museum collections were used: Florida Museum of Natural History, University of Florida (UF), and the Museum of Vertebrate Zoology, University of California at Berkeley (MVZ); a single juvenile specimen of *B. oresbia* from the type locality (JHT 2225) used for genetic comparison will be permanently deposited in one of the aforementioned museum collections at a later date. Forest formation definitions follow those of Holdridge (1967).

Template DNA was extracted from muscle tissue with a PureGene DNA Isolation Kit (Qiagen, Chatsworth, USA) following manufacturer's instructions, and stored at -20°C. Polymerase chain reaction (PCR) amplifications of double stranded product were performed on an Eppendorf thermocycler. We amplified a 692 base pair segment of cyt *b* using primers MVZ15-L and MVZ18-H (Moritz et al. 1992), to compare with published data on this genus (Garcia-Paris et al. 2000; Parra-Olea et al. 2002, 2004). PCR reactions contained 1 X PCR, 2 mM $MgCl_2$, 0.3 mM dNTPs, 0.4 µM primer, 0.2 units of Taq polymerase and 50 ng template DNA in a total volume of 20 µl. Conditions for PCR did not differ between genes and included an initial denaturation at 94°C for 3 min, 35 amplification cycles of 45 s denaturation at 94°C, 45 s annealing at 50°C, 45 s extension at 72°C and a final extension of 5 min at 72°C. Samples were cleaned of unincorporated dNTPs through application of ExoSAP-IT (USB, Cleveland, USA) before following standard sequencing protocol on the ABI 3130xl automated sequencer (Applied Biosystems, Foster City, USA) at the University of Florida Conservation and Evolutionary Genetics Lab.

Cyt *b* sequence data from all recognized members of the species group were obtained from GenBank (Table 1). Published sequences were aligned with our sequences using ClustalX (Thompson et al. 1997). Pairwise comparisons of corrected sequence divergence (Kimura-2 parameter; Kimura 1980) were generated using Mega 4.0 (Tamura et al. 2007).

Systematics

Bolitoglossa cataguana sp. n.
(Figs. 1, 2A, 2B)

Holotype: An adult female (UF 151786; Figs. 1, 2A) from Honduras, Departamento de Francisco Morazán, Municipio de Marale, Parque

Fig. 1. Dorsolateral view of holotype of *Bolitoglossa cataguana* sp. n. (UF 151786) in life during daytime. Photo: Josiah H. Townsend.

Fig. 2A. In situ view of holotype of *Bolitoglossa cataguana* sp. n. (UF 151786) in life during nighttime; Fig. 2B. In situ view of female paratype of *Bolitoglossa cataguana* sp. n. (MVZ 258030) in life during nighttime. Photos: Scott L. Travers.

Nacional Montaña de Yoro, trail above Quebrada Cataguana (15°01'N 87°06'W), 1850 m elevation, collected by J. Michael Butler, Lorraine P. Ketzler, Robert E. Lovich, Josiah H. Townsend, Scott L. Travers, Laura Vietti, and Larry D. Wilson on 14 March 2007. Original field number JHT 2114.

Paratypes: Six; subadult female (MVZ 258028), above Quebrada Cataguana, 1840 m, collected by J.H. Townsend and L.D. Wilson on 12 June 2006; apparently subadult male (MVZ 258029), above Quebrada Cataguana, 1825 m, collected by J.H. Townsend and L.D. Wilson on 14 June 2006; adult female (MVZ 258030; Fig. 2B), trail above

Tab. 1. Summary of relevant data for species in the *Bolitoglossa (Magnadigita) dunni* group; mtDNA sequences for B. cataguana and B. oresbia morphological data for species other than *B. cataguana* sp. nov. are based on the relevant literature (Elias 1984, Greenbaum 2004, McCranie & Wilson 2002, McCranie et al. 2005, Wake & Brame 1969); ranges of measurements or ratios are followed by their mean in parentheses; ♂ = male, ♀ = female.

Taxon	Locality	GenBank accession numbers	GenBank voucher specimens	SVL (mm); sample size
Bolitoglossa carri	Honduras: Francisco Morazán: Cerro Cantagallo	AY526175-76	USNM 523267-68	37.4-48.0 (42.6) ♂, N=14; 42.4-58.1(49.9) ♀, N=9
B. cataguana	Honduras: Francisco Morazán: Montaña de Yoro	Submitted	MVZ 258030, 258032; UF 151786	40.4 ♂, N=1; 35.3-49.7 (43.9) ♀, N=4
B. celaque	Honduras: Lempira: Cerro Celaque	AY526177-78	SMF 78087-88	42.2-55.1 (49.6) ♂, N=19; 39.2-62.2 (50.6) ♀, N=11
B. conanti	Honduras: Cortés: El Cusuco	AY526179	MVZ 225843	40.2-50.1 (45.9) ♂, N=17; 40.3-50.1 (44.5) ♀, N=12
B. decora	Honduras: Olancho: La Muralla	AY526180	USNM 497533	36.5-40.2 (38.4) ♂, N=2; 61.0-62.1 (61.6) ♀, N=2
B. diaphora	Honduras: Cortés: El Cusuco	AY526181	MVZ 225847	42.4-50.4 (45.9) ♂, N=5; 48.1-51.9 (50.5) ♀, N=3
B. dunni	Honduras: Cortés: Sierra de Omoa	AY526182	USNM 523280	47.9-59.6 (53.5) ♂, N=10; 50.1-57.2 (53.5) ♀, N= 4
B. flavimembris	Guatemala: San Marcos	AY526183	MVZ 142698	45.5-55.4 (50.1) ♂, N=9; 43.5-64.4 (54.4) ♀, N=21
B. heiroreias	El Salvador: Santa Ana: Montecristo	AY526191-92	MVZ 200535, 233028	31.5-44.9 (38.6) ♂, N=9; 25.6-63.1 (44.2) ♀, N=20
B. longissima	Honduras: Olancho: Pico La Picucha	AY526186	USNM 523285	45.7-48.2 (47.0) ♂, N=2; 51.0-61.1 (54.6) ♀, N=5
B. morio	Guatemala: San Marcos	AY526187	MVZ 232970	34.5-48.6 (43.0) ♂, N=15; 32.1-65.7 (46.4) ♀, N=12
B. oresbia	Honduras: Comayagua: Cerro Zarciadero	Submitted	JHT 2225	50.8-55.5 (53.2) ♀, N= 2
B. porrasorum	Honduras: Atlantída: Cerro Búfalo	AY526188	MVZ 225852	47.6-58.1 (52.6) ♂, N=12; 51.6-61.4 (56.9) ♀, N=9
B. synoria	Honduras: Ocotepeque: El Pital	AY526193	SMF 78084	37.4-52.0 (46.8) ♂, N=13; 31.2-59.8 (46.5) ♀, N=11

Quebrada Cataguana, 1850 m, collected by J.M. Butler, L.P. Ketzler, R.E. Lovich, J.H. Townsend, S.L. Travers, L. Vietti, and L.D. Wilson on 14 March 2007; adult female (MVZ 258031), Cerro el Filón, above Cataguana, 2080 m, collected by aforementioned field party on 14 March 2007; juvenile (MVZ 258032), above Quebrada Cataguana, 1800 m, collected by aforementioned field party on 12 March 2007; juvenile (MVZ 258033), Cerro el Filón, above Cataguana, 2050 m, collected by aforementioned field party on 14 March 2007.

Diagnosis: A medium sized *Bolitoglossa* in the subgenus *Magnadigita* Taylor (sensu Par-

HW/SVL	TL/SVL	HLL/SVL	Free phalanges: forelimb digit III	Relative lengths: forelimb digits
0.159-0.177 (0.171) ♂; 0.150-0.170 (0.163) ♀	0.739-0.830 (0.792) ♂; 0.679-0.741 (0.706) ♀	0.257-0.291 (0.275) ♂; 0.241-0.285 (0.262) ♀	1.0-2.0	I < II < IV < III
0.181 ♂; 0.177-0.198 (0.184)♀	0.856 ♂; 0.635- 0.761 (0.716) ♀	0.262 ♂; 0.209-0.258 (0.237) ♀	1.0-2.0	I < II ≈ IV < III
0.147-0.169 (0.157) ♂; 0.144-0.173 (0.156) ♀	0.768-0.987 (0.882) ♂; 0.776-0.868 (0.810) ♀	0.263-0.301 (0.283) ♂; 0.254-0.285 (0.273) ♀	1.5-2.0	I < II < IV < III
0.148-0.173 (0.161) ♂; 0.144-0.172 (0.162) ♀	0.747-1.112 (0.969) ♂; 0.715-0.889 (0.831) ♀	0.246-0.334 (0.290) ♂; 0.245-0.321 (0.279) ♀	1.5-2.0	I < II < IV < III
0.157-0.164 (0.161) ♂; 0.161-0.163 (0.162) ♀	0.749 ♂; 0.757-0.770 (0.764) ♀	0.249-0.264 (0.257) ♂; 0.241-0.253 (0.247) ♀	2.0-2.5	I < II ≈ IV < III
0.153-0.169 (0.160) ♂; 0.163-0.177 (0.169) ♀	0.431-0.719 (0.636) ♂; 0.607-0.608 (0.608) ♀	0.263-0.293 (0.277) ♂; 0.241-0.260 (0.252) ♀	Slight indentation to 2nd phalanx	I < IV < II < III
0.162-0.178 (0.170) ♂; 0.168-0.184 (0.175) ♀	0.895-1.005 (0.946) ♂; 0.839-0.884 (0.859) ♀	0.255-0.298 (0.273) ♂; 0.250-0.271 (0.260) ♀	0.5-1.5	I < II < IV < III
0.148-0.164 (0.156) ♂; 0.148-0.177 (0.164) ♀	0.642-0.838 (0.745) ♂; 0.662-0.775 (0.716) ♀	0.245-0.315 (0.284) ♂; 0.263-0.328 (0.290) ♀	1.5-2.0	I < IV < II < III
0.157-0.203 (0.179) ♂; 0.159-0.206 (0.172) ♀	0.716-0.839 (0.780) ♂; 0.578-0.822 (0.735) ♀	0.294-0.343 (0.313) ♂; 0.259-0.350 (0.302) ♀	1.5-2.0	I < IV < II < III
0.155-0.162 (0.159) ♂; 0.163-0.181 (0.169) ♀	0.768-0.888 (0.828) ♂; 0.809-0.963 (0.888) ♀	0.319-0.324 (0.322) ♂; 0.302-0.319 (0.313) ♀	2.0-2.5	I < II ≈ IV < III
0.138-0.168 (0.152) ♂; 0.138-0.175 (0.156) ♀	0.623-0.849 (0.750) ♂; 0.549-0.762 (0.647) ♀	0.249-0.362 (0.319) ♂; 0.261-0.322 (0.285) ♀	2.0-2.5	I < IV < II < III
0.157-0.160 (0.158) ♀	0.817-0.870 (0.844) ♀	0.260- 0.270 (0.265) ♀	1.5-2.0	I < II < IV < III
0.156-0.176 (0.168) ♂; 0.163-0.174 (0.168) ♀	0.776-1.087 (0.925) ♂; 0.762-0.884 (0.844) ♀	0.266-0.299 (0.280) ♂; 0.247-0.275 (0.262) ♀	1.5-2.0	I < II ≈ IV < III
0.152-0.188 (0.165) ♂; 0.153-0.181 (0.166) ♀	0.755-0.900 (0.823) ♂; 0.691-0.719 (0.705) ♀	0.260-0.292 (0.279) ♂; 0.246-0.285 (0.264) ♀	2.0-2.5	I < II ≈ IV < III

ra-Olea et al. 2004), *B. cataguana* is differentiated from all Mesoamerican salamanders, other than those of the genus *Bolitoglossa*, by having 13 costal grooves and hind feet broader than they are long (>16 costal grooves in *Oedipina*, hind feet longer than they are broad in *Cryptotriton*, *Dendrotriton*, and *Nototriton*). *Bolitoglossa cataguana* can be distinguished from all other congeners, besides those in the *B. dunni* group (except for *B. diaphora*), by having well-developed subdigital pads and bluntly rounded toe tips; one species in the *B. dunni* group, *B. diaphora*, lacks well-developed subdigital pads and bluntly rounded toe tips. Of the remaining species in the *B. dunni* group, *B. cataguana* differs from *B. carri*, *B.*

conanti, *B. decora*, *B. oresbia*, and *B. porrasorum* by lacking well defined dorsal blotches or a middorsal stripe (*B. carri* has pale dorsolateral stripes originating posterior to the eyes, *B. conanti* has a middorsal stripe that may be broken into blotches or reduced to the dorsal surface of the base of the tail, *B. decora* has large yellow dorsal blotches [additional characters differentiating *B. cataguana* from *B. decora* are presented below], *B. oresbia* has small yellow dorsolateral blotches, and *B. porrasorum* has some degree of irregular dorsal, lateral, ventral, or subcaudal blotches), from *B. celaque* by having a brown or dark brown subcaudal surface (pale yellow to pale orange in *B. celaque*), from *B. dunni* by lacking conspicuous gold or white spots on the dorsal surfaces of hands and feet (*B. dunni* has gold or white spots on the dorsal surfaces of hands and feet), from *B. longissima* by having 1.0-2.0 free phalanges on the third finger and HLL/SVL <0.300 (2.0-2.5 free phalanges on third finger and HLL/SVL >0.300 in *B. longissima*), from *B. heiroreias* by having HLL/SVL=0.262 in one known male and HLL/SVL ≤0.258 in females (HLL/SVL ≥0.294 in males and HLL/SVL ≥0.259 in females of *B. heiroreias*), and from *B. synoria* by having 1.0-2.0 free phalanges on the third finger (2.0-2.5 free phalanges on third finger in *B. synoria*). Morphological variation data for species of the *B. dunni* group for selected characteristics are summarized in Table 1.

Bolitoglossa cataguana is well-differentiated from other species in the *B. dunni* group on the basis of mtDNA sequence divergence. Corrected cyt *b* sequence divergence between *B. cataguana* and other species of the group ranged from 3.0% (*B. decora*) to 20.5% (*B. conanti*) on cyt *b*; divergence among sequences from three samples of *B. cataguana* was a maximum of 0.0-0.5% on cyt *b* (Table 2). The divergence between *B. cataguana* and *B. decora* is at the low end of divergence within the genus, but similar to that found between other distinct species (*B. mombachoensis* versus *B. striatula* at 2.9%, Parra-Olea et al. 2004). These two species differ on the base of colour pattern (described above), and *B. cataguana* has a wider head (HW/SVL ≥0.177, versus ≤0.164 in *B. decora*) and has 1.0-2.0 free phalanges on the third finger (2.0-2.5 free phalanges on third finger in *B. decora*).

Description of the holotype: Snout truncate in dorsal view, rounded in profile; labial protuberances moderately well-developed; mental gland absent; suborbital groove distinct; eyes and eyelids somewhat protuberant, not visible beyond edge of jaw when viewed from below; postorbital groove well-defined, taking a sharp ventral turn posterior to mandible, extending across throat as a relatively poorly defined groove 4.1 mm anterior to well-defined gular fold; 51 maxillary teeth, extending to level of posterior half of orbit; 6 premaxillary teeth located posterior to lip and aligned to maxillary tooth series, separated from maxillary teeth by gaps equivalent to about two tooth sockets; vomerine teeth about 21, in two arched series, extending just beyond level of outer edge of internal nares; tail somewhat rectangular in cross section for anterior one-half of its length, becoming more rounded posteriorly; tail strongly constricted basally, appearing swollen posterior to basal constriction; limbs relatively slender, long, limb interval about 1.0 costal fold; digits moderately webbed, one and one-half to two segments on Toe III on both forelimbs and hind limbs free of webbing; subdigital pads well-developed on both forelimbs and hind limbs; digit tips bluntly rounded; relative length of digits on forelimbs I < II ≈ IV < III, relative length of hind limb digits I < II < V < IV < III.

Measurements and proportions of holotype (in mm): SVL 45.4; HL 12.0; HL/SVL 0.26; HW 8.1; head depth at posterior angle of jaws 4.6; eyelid length 3.6; eyelid width 1.4; anterior rim of orbit to snout (medially) 2.4; horizontal orbital diameter 1.9; interorbital distance 2.9; snout (medially) to forelimbs 14.8; distance separating internal nares 2.2; distance separating external nares 3.0; snout projection beyond mandible 0.9; AG 23.2;

Tab. 2. Genetic distances corrected with the Kimura 2 parameter based on cyt-b sequences between pairs of *Bolitoglossa dunni* group species. Within species distances are provided in bold text on the upper diagonal when multiple samples were included.

Voucher number	Species	1	2	3	4	5	6	7	8	9	10	11	12	13
1 USNM 523267–68	*B. carri*	**0.0**												
2 MVZ 258030, 258032; UF 151786	*B. cataguana*	0.165	**0.005**											
3 SMF 78087–88	*B. celaque*	0.152	0.163	**0.003**										
4 MVZ 225843	*B. conanti*	0.103	0.205	0.156	–									
5 USNM 497533	*B. decora*	0.160	0.030	0.156	0.173	–								
6 MVZ 225847	*B. diaphora*	0.147	0.144	0.134	0.128	0.129	–							
7 USNM 523280	*B. dunni*	0.115	0.150	0.138	0.120	0.136	0.132	–						
8 MVZ 142698	*B. flavimembris*	0.143	0.188	0.151	0.151	0.183	0.120	0.136	–					
9 MVZ 200535, 233028	*B. heirorias*	0.160	0.179	0.105	0.141	0.173	0.137	0.145	0.141	**0.007**				
10 USNM 523285	*B. longissima*	0.138	0.171	0.157	0.160	0.172	0.157	0.132	0.160	0.150	–			
11 JHT 2225	*B. oresbia*	0.104	0.156	0.152	0.103	0.160	0.129	0.111	0.143	0.160	0.156	–		
12 MVZ 225852	*B. porrasorum*	0.146	0.144	0.138	0.155	0.147	0.155	0.163	0.178	0.154	0.143	0.160	–	
13 SMF 78084	*B. synoria*	0.137	0.173	0.041	0.145	0.173	0.128	0.114	0.136	0.099	0.137	0.132	0.136	–

snout to anterior edge of vent length 42.9; TW 7.3; TW/SVL 0.16; TL 32.0; TL/SVL 0.70; tail width at basal constriction 4.2; tail depth at basal constriction 4.4; FLL 11.6; HLL 11.7; HLL/SVL 0.26; right forefoot width 3.7; right hind foot width 4.8; HFW/SVL 0.11.

Colour in life: Colour in life of the holotype, based on a photograph taken the next day during daylight hours (Fig. 1), is as follows: dorsum of head, body, and tail gray-brown with pale ocher cast and scattered dark brown punctations, these punctations coalescing toward end of tail; lateral portion of body dark chocolate brown, the upper edge ragged; anterior limbs pale ocher with scattered dark brown punctations; hind limbs pale ocher with scattered dark brown punctations and a pale cream spot at base; iris rust red with gold flecking. Colouration of the holotype in life, based on an in situ photograph taken at night (Fig. 2A): dorsum of body pale grayish tan with pale pink cast and dark brown pigment narrowly and discontinuously distributed along costal grooves; dorsum of tail pale grayish tan with pale pink cast; anterior limbs pale ocher with scattered brown markings; hind limbs pale grayish brown with scattered brown spotting and flecking, a brown anklet band, and a pale ocher and cream spot at base of leg; iris rust red with gold flecking.

Variation: None of the type series of *Bolitoglossa cataguana* possessed visible mental glands, typically used to identify adult males. One specimen (MVZ 258029) differs notably from the other non-juvenile specimens in having a much narrower body (trunk width/SVL = 0.124, versus 0.161-0.197 in four females); this specimen is considered a subadult male, since males in species of the *B. dunni* group are typically more slender than adult females, which can have a relatively robust habitus. MVZ 258029 further differs from the adult and subadult females in having a relatively longer tail (TL/SVL =0.856, versus 0.635-0.761 in four females) and relatively longer hind limbs (HLL/SVL =0.262, versus 0.209-0.258 in four females). The three female paratypes also have relatively shorter legs than the holotype (0.209-0.243 versus 0.258 in holotype). Relative to the five adult specimens, two juvenile paratypes (MVZ 258032-33) have shorter tails (TL/SVL 0.420-0.527, versus 0.635-0.856 in five adults) and wider heads (HW/SVL 0.216-0.217, versus

0.177-0.198 in five adults). The male (MVZ 258029) has 52 maxillary teeth, 4 premaxillary teeth set forward of the maxillary tooth series (rather than aligned as in the females), and 23 vomerine teeth arranged to two arches; two females (MVZ 258030-31) have 48-59 maxillary teeth, 5-7 premaxillary teeth aligned to maxillary tooth rows.

Colouration in life of an apparently subadult male (MVZ 258029) was noted during the daytime as follows: dorsum of head, body, and tail dark brown, becoming slightly paler towards snout; upper leg with profuse yellow-tan and dark brown blotches, lower leg brown; upper arm with yellow-tan and dark brown blotches, lower arm brown; tail with scattered small tan flecks; chin tan; ventral surface of body brown, with scattered silver iridiophores and a series of irregular rust-brown midventral blotches; subcaudal surface dark brown; iris gold with rust-brown reticulations. Colouration in life of an adult female (MVZ 258030; Fig. 2B) was recorded during the daytime as follows: dorsum gray brown with scattered dark gray flecks; limbs gray brown, hind limbs with pale yellow spot at base; venter pale pinkish gray; subcaudal surface brown; iris copper red. Colouration in life of a subadult female (MVZ 258028) was recorded during the daytime as follows: dorsum of head, body, and tail dark brown; upper portion of limbs with cream and brown blotching; lower limbs and feet medium brown; chin brown; ventral surface of body and tail dark brown; underside of limbs brown; iris rust red with gold flecks and gold ring around pupil. Colouration in life of a small juvenile (MVZ 258032) was recorded during the daytime as follows: dorsum brown, ventral surfaces of body and tail pale brown with dark brown punctations and scattered white spots; iris silver with black reticulations.

Etymology: The specific name *cataguana* (pronounced *cat-a-wan-a*) is a noun in apposition to the generic name, given to honor the community and working forest where the type series was collected, and to highlight this endemic species as part of the environmental patrimony of Montaña de Yoro's residents.

Distribution and natural history notes: This new species is known from the vicinity of the frontier community of Cataguana, in the Lower Montane Wet Forest formation between 1800 and 2080 m elevation on the western edge of Parque Nacional Montaña de Yoro, central Honduras. All specimens were collected in lightly disturbed Mixed Cloud Forest (as defined in Mejía V. 2001) with an overstory including the trees *Cedrela odorata*, *Liquidambar styraciflua*, *Nectandra gentlei*, *Pinus ayacahuite*, *P. tecunumanii*, *Podocarpus guatemalensis*, *Quercus oleoides*, *Q. peduncularis*, and *Q. skinneri* (COHECO 2003).

Two juveniles were collected in March: one while active on a small plant 0.25 m above the ground at 1800 m elevation next to a stream, and the other on a small plant 0.5 m above the ground along a ridge at 2050 m elevation. An adult female was found sleeping during the daytime under a log on top of a ridge at 2080 m elevation. The rest of the type series was collected on a steep hillside above Quebrada Cataguana, from 1800-1850 m elevation, at night while the animals were active on vegetation 0.5-3.0 m above the ground.

Conservation Status: Based on criteria designated by the IUCN (2001) and used in the Global Amphibian Assessment (www.globalamphibians.org), *Bolitoglossa cataguana* should be classified as Critically Endangered (B1ab[iii]+2ab[iii]) due to its limited distribution and the direct threat to the known remaining habitat posed by the continually and rapidly advancing local agricultural frontier.

Discussion

Mesoamerican cloud forests display a remarkable degree of localized endemism (Campbell 1999), and the Honduran amphibian fauna exemplifies this pattern (McCranie & Wilson 2002, Townsend & Wilson 2008,

Wilson & McCranie 2004). In Honduras, at least 24 species of amphibians are known to occur in only a single isolated cloud forest area, and most areas support a suite of species found only at that site (McCranie & Castañeda 2007, McCranie et al. 2008, Wilson & McCranie 2004). Both *Bolitoglossa cataguana* and its sister species, *B. decora*, are limited in distributions to isolated areas of Lower Montane Wet Forest above 1800 m and 1430 m elevation, respectively, that are separated by about 45 km and the subhumid valley carved by upper tributaries of the Río Aguán. Lower elevations of the valley are between 500 and 600 m, and the formerly *Pinus*-dominated subhumid landscape is now largely given over to agriculture. The Lower Montane Wet Forest habitat of Montaña de Yoro and La Muralla is characterized by high rainfall, frequent envelopment by occult precipitation (the "cloud forest" effect), and relatively cool temperatures. The higher temperatures and subhumid climate within the intervening valley prohibits migration between congeners occurring in the cloud forests of Montaña de Yoro and La Muralla. This vicariance produces the pattern observed between *B. cataguana* and *B. decora*, as well as other herpetofauna. The type locality of *B. cataguana* is also the type and only known locality for the recently described lizard *Anolis morazani* (Townsend & Wilson 2009), which was discovered during the same visits that produced the type series of *B. cataguana*. This species is a member of the *A. crassulus* group, which also has a representative endemic to Parque Nacional La Muralla, *A. muralla*.

As noted above, 10 of the 12 known species of the *Bolitoglossa dunni* group are endemic to Honduras or nearly so (McCranie & Castañeda 2007, McCranie & Wilson 2002), not including the species described herein. As a group, these 10 species are broadly distributed throughout the elevated regions of Honduras that contain cloud forest (McCranie et al. 2005). Of these 10 species, five (*B. carri*, *B. decora*, *B. diaphora*, *B. longissima*, and *B. synoria*) are restricted to a single cloud forest site. We expect that additional fieldwork in currently unsurveyed cloud forest regions will uncover additional undescribed members of this group, inasmuch as *B. dunni* group species typically are members of the suite of species occurring in Honduras cloud forests.

Bolitoglossa cataguana is recommended for recognition as Critically Endangered on the IUCN Red List, as noted above. Of the 10 other Honduras members of the *B. dunni* group, five are considered as Critically Endangered (*B. carri*, *B. diaphora*, *B. longissima*, *B. oresbia*, and *B. synoria*) and the other five as Endangered (*B. celaque*, *B. conanti*, *B. dunni*, *B. heiroreias*, and *B. porrasorum*; Townsend & Wilson in press). This degree of threat as indicated by IUCN Red List status is typical of the members of the cloud-forest herpetofauna in Honduras (Townsend & Wilson in press).

Parque Nacional Montaña de Yoro is one of the least well-known of Honduran cloud forests, which in general support a high degree of localized endemism (Wilson & McCranie 2004). The reserve has a total area of over 154 km², with more than 47 km² of area above 1800 m, making Parque Nacional Montaña de Yoro one of the more significant areas of cloud forest in Honduras (COHECO 2003). The discovery of *B. cataguana* and *A. morazani* during limited fieldwork in Parque Nacional Montaña de Yoro should be considered an indicator of additional undocumented endemism awaiting discovery within the reserve, both in terms of the herpetofauna as well as other taxonomic groups.

Acknowledgements

We thank Saíd E. Laínez Orellana and Teresa Espinosa Aguilar of the Alcadía del Municipio de Marale, and Luis M. Ramos, *guardabosque* of Parque Nacional Montaña de Yoro, for facilitating and assisting in our work in and around Cataguana; Alicia Criado provided housing in Marale during our work; Carla Cárcamo de Martinez, Ramón Alvarez L., Wilson D. Zúniga D.,

Sonia Martínez Moreno, Wendy Aronne, and Iris Acosta of the Departamento de Areas Protegidas y Vida Silvestre (DAPVS), AFE-COHDEFOR, for aiding in the acquisition of collecting and export permits; and L.P. Ketzler, R.E. Lovich, S.L. Travers, and L. Vietti for assistance in the field during March 2007. Research in Honduras was conducted under permits GG-MP-055-2006 and DAPVS-0091-2006. Mario R. Espinal and Ismael Murga assisted with vehicles and transportation in 2006; Centro Zamorano de Biodiversidad provided our vehicle and other logistical support in 2007, and we especially thank Jorge Iván Restrepo for facilitating this support. Fieldwork in 2006 was funded by a Summer Research Grant from the Working Forests in the Tropics IGERT Program at the University of Florida, supported by the National Science Foundation (DGE-0221599), and by a grant from the Reptile and Amphibian Conservation Corps (RACC). JHT was supported by a National Science Foundation GK-12 Teaching Fellowship awarded by the University of Florida SPICE Program, a University of Florida Foundation Grinter Fellowship, and a grant from the Critical Ecosystem Partnership Fund (CEPF) during preparation of this manuscript. Ileana R. Luque-Montes kindly translated the abstract into Spanish. Donation of the type specimens was facilitated by Max A. Nickerson (UF) and David B. Wake, Ted J. Papenfuss, Carol L. Spencer, and Jim A. McGuire (MVZ).

References

COHECO (2003): Plan de Manejo Parque Nacional Montaña de Yoro. – AFE-COHDEFOR, DAPVS, Regíon Forestal Francisco Morazán, and Regíon Forestal Yoro.

Cruz, G. A., L. E. Girón. S. Flores & V. Henríquez (2006): Evaluación de la herpetofauna en las partes que formarán el Área Protegida Trinacional Montecristo en territorio Guatemalteco y Hondureño. Anexo 3. – in Evaluación ecológica rápida en el Área Protegida Trinacional Montecristo en territorio Guatemalteco y Hondureño. Informe de Consultoría para el Banco Interamericano de Desarrollo. – San Salvador: SalvaNATURA Programa de Ciencias para la Conservación.

Garcia-Paris, M., G. Parra-Olea & D. B. Wake (2000): Phylogenetic relationships within the lowland tropical salamanders of the *Bolitoglossa mexicana* complex (Amphibia: Plethodontidae). – in The Biology of Plethodontid Salamanders. – Kluwer Academic, Plenum Publishers, New York.

Elias, P. (1984): Salamanders of the northwestern highlands of Guatemala. – Contributions to Science, Natural History Museum of Los Angeles County, **348**: 1-20.

Greenbaum, E. (2004): A new species of *Bolitoglossa* (Amphibia: Caudata: Plethodontidae) from montane forests in Guatemala and El Salvador. – Journal of Herpetology, **38**: 411-421.

Holdridge, L. R. (1967): Life zone ecology. Revised edition. – Tropical Science Center, San José, Costa Rica.

IUCN (2001): IUCN Red List Categories and Criteria: Version 3.1. – IUCN Species Survival Commission, IUCN, Gland, Switzerland and Cambridge, United Kingdom.

Kimura, M. (1980): A simple method for estimating evolutionary rate of base substitutions through comparative studies of nucleotide sequences. – Journal of Molecular Evolution, **16**: 111-120.

McCranie, J. R. & L. D. Wilson (1993): A review of the *Bolitoglossa dunni* group (Amphibia: Caudata) from Honduras with the description of three new species. – Herpetologica, **49**: 1-15.

McCranie, J. R. & L. D. Wilson (2002): The amphibians of Honduras. – Society for the Study of Amphibians and Reptiles, Ithaca, NY.

McCranie, J. R., M. R. Espinal & L. D. Wilson (2005): A new species of montane salamander of the *Bolitoglossa dunni* group from northern Comayagua, Honduras (Urodela: Plethodontidae). – Journal of Herpetology, **39**: 108-112.

McCranie, J. R. & F. E. Castañeda (2007): Guia del campo de los anfibios de Honduras. – Bibliomania!, Salt Lake City, Utah.

McCranie, J. R., D. R. Vieites & D. B. Wake (2008): Description of a new divergent lineage and three new species of Honduran salamanders of the genus *Oedipina* (Caudata, Plethodontidae). – Zootaxa, **1930**: 1-17.

Mejía V., D. A. (2001): Honduras. – pp. 243-282 in Bosques Nublados del Neotrópico. – Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica, 704 pp.

Moritz, C., C. J. Schneider & D. B. Wake (1992): Evolutionary relationships within the *Ensatina*

eschscholtzii complex confirm the ring species interpretation. – Systematic Biology, **41:** 273-291.

Parra-Olea, G., M. García-París & D. B. Wake (2002): Phylogenetic relationships among the salamanders of the *Bolitoglossa macrinii* species group (Amphibia: Plethodontidae), with descriptions of two new species from Oaxaca (Mexico). – Journal of Herpetology, **36**: 356-366.

Parra-Olea, G., M. García-París & D. B. Wake (2004): Molecular diversification of salamanders of the tropical American genus *Bolitoglossa* (Caudata: Plethodontidae) and its evolutionary and biogeographical implications. – Biological Journal of the Linnean Society, **81**: 325-346.

Tamura, K., J. Dudley, M. Nei, & S. Kumar (2007): MEGA4: Molecular Evolutionary Genetics Analysis (MEGA) software version 4.0. – Molecular Biology and Evolution, **24**: 1596-1599.

Thompson, J. D., T. J. Gibson, F. Plewniak, F. Jeanmougin & D. G. Higgins (1997): The ClustalX windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. – Nucleic Acids Research, **24**: 4876-4882.

Tilley, S. G. (1981): A new species of *Desmognathus* (Amphibia: Caudata: Plethodontidae) from the southern Appalachian mountains. – Occasional Papers of the Museum of Zoology, University of Michigan, **695**: 1-23.

Townsend, J. H. & L. D. Wilson (2008): Guide to the amphibians and reptiles of Cusuco National Park, Honduras/Guia de los anfibios y reptiles de Parque Nacional Cusuco, Honduras. – Bibliomania!, Salt Lake City, Utah.

Townsend, J. H. & L. D. Wilson (2009): New species of cloud forest Anolis (Squamata: Polychrotidae) of the *crassulus* group from Parque Nacional Montaña de Yoro, Honduras. – Copeia, **2009(1)**: 62-70.

Townsend, J. H. & L. D. Wilson. (in press): Conservation of the Honduran herpetofauna: issues and imperatives. In: Conservation of Mesoamerican amphibians and reptiles. – Eagle Mountain Publishing, LC, Eagle Mountain, Utah, and Bibliomania!, Salt Lake City, Utah.

Wake, D. B. (1987): Adaptive radiation of salamanders in Middle American cloud forests. – Annals of the Missouri Botanical Garden, **74**: 242-264.

Wake, D. B. & A. H. Brame, Jr. (1969): Systematics and evolution of neotropical salamanders of the *Bolitoglossa helmrichi* group. – Los Angeles County Museum Contributions to Science, **175**: 1-40.

Wake, D. B. & P. Elias (1983): New genera and a new species of Central American salamanders, with a review of the tropical genera (Amphibia, Caudata, Plethodontidae). – Contributions to Science, Los Angeles County Museum, **345**: 1-19.

Wiens, J. J., G. Parra-Olea, M. García-París & D. B. Wake (2007): Phylogenetic history underlies elevational biodiversity patterns in tropical salamanders. – Proceedings of the Royal Society B, **274**: 919-928.

Wilson, L. D. & J. R. McCranie (2004): The herpetofauna of the cloud forests of Honduras. – Amphibian and Reptile Conservation, **3**: 31-48.

Manuscript received: 22 February 2008

Authors' addresses: Josiah H. Townsend, School of Natural Resources and Environment and Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-7800, USA, and Instituto Regional de Biodiversidad (IRBio), Centro Zamorano de Biodiversidad, Escuela Agrícola Panamericana Zamorano, Depto. de Francisco Morazán, Honduras, E-Mail: jtwnsnd@ufl.edu; J. Michael Butler, Department of Wildlife Ecology and Conservation and Florida Museum of Natural History, University of Florida, Gainesville, Florida 32611-0430, USA; Larry David Wilson, Instituto Regional de Biodiversidad (IRBio), Centro Zamorano de Biodiversidad, Escuela Agrícola Panamericana Zamorano, Depto. de Francisco Morazán, Honduras; James D. Austin, Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, Florida 32611-0430, USA.