

Filling a gap in the distribution of the Berthold's Bush Anole, *Polychrus guttuerosus* (Squamata, Polychrotidae), in Honduras

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<https://zoobank.org/3639462C-6907-43FA-AD88-0EC3F21BB12F>

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Academic editor: Günter Gollmann ♦ Received 19 May 2022 ♦ Accepted 24 October 2022 ♦ Published 14 November 2022

Abstract

The family Polychrotidae Fitzinger, 1843 is represented in Honduras by a single species, *Polychrus guttuerosus* Berthold, 1845. This canopy dweller is distributed in the lowland moist forests and riparian forest within pine savannah of the northern and eastern regions of Honduras. Only 13 records and nine localities support the presence of the species in the country; therefore, the distribution and natural history of the species in Honduras is essentially unknown. Herein, we provide a new locality and natural history observations of a specimen captured in the core zone of the Reserva del Hombre y La Biosfera del Río Plátano. This record represents the north-western most occurrence of *Polychrus guttuerosus* in a region known as the Mosquitia and fills an important distributional gap for this poorly known species.

Key Words

canopy, Colón Department, conservation, herpetofauna, La Mosquitia, microhabitat, natural history, protected natural area

Introduction

The family Polychrotidae Fitzinger, 1843, is currently considered monogean (Townsend et al. 2011; McCranie 2018). The only known genus in this family is *Polychrus* Cuvier, 1816, and eight species are currently recognized (Uetz et al. 2022). However, *Polychrus guttuerosus* Berthold, 1845, is the only species known to be naturally dispersed within Central America (Uetz et al. 2022), from northern Honduras to northwestern Colombia and western Ecuador (Köhler 2008; McCranie 2018) in elevations from sea level to 1300 m (Castro-Herrera and Vargas-Salinas 2008).

In Honduras, *P. guttuerosus* have been detected at low elevations from 10 to 410 m in the Caribbean slope, northern and eastern region, in the departments of Atlántida, Cortés, and Gracias a Dios (Solís et al. 2017; McCranie 2018). Most occurrences have been recorded in Gracias a Dios department, which is adjacent to Nicaragua (Meyer and Wilson 1973; Solís et al. 2017; McCranie 2018). Solís et al. (2017) mentioned that their reports are the northernmost records because they considered the oldest and northernmost record from 1923 of *P. guttuerosus* at Guaimas (=Guaymas) as tentative. Currently, African palm crops have displaced the forest habitat of Guaimas since these records. On the other hand, McCranie (2018) revised UMMZ (University of

Michigan Museum of Zoology) 58369, recognizing this locality as the northernmost extent of *P. guttuosus*; however, additional records provided by Solís et al. (2017) were not considered. We consider that McCranie (2018) did not include the records of Solís et al. (2017), possibly, due to the editorial processes of his book. Gómez-Hoyos et al. (2015) presented the distribution of *P. guttuosus*, including a locality in western Honduras; we considered this record to be wrong, therefore, we did not include it. We noted that some localities in the map presented by McCranie (2018) have slight variations with respect to the coordinates presented in the UMMZ and USNM (United States National Museum) herpetological collections databases. Such is the case with the locality of UMMZ 58369, considered as Guaimas (=Guaymas) by McCranie (2018), because those coordinates are referred to the department of Yoro. As for the Reserva del Hombre y la Biosfera del Río Plátano (RHBRP), a protected area whose habitat has been reduced at a significantly accelerated rate in recent decades (McCranie et al. 2006; McCranie 2018; Medina-Fitoria et al. 2020). House et al. (2002) mentioned *P. guttuosus* in the list of herpetofauna for the protected area but fail to present evidence.

Polychrus guttuosus is a diurnal and arboreal species, inhabiting mainly the forest canopy (Savage 2002). In addition, Roberts (1997), Köhler (2003), and McCranie et al. (2006) considered that the rarity of this species is due to the height above ground at which it lives. Therefore, populations of this species appear to have low densities and live almost exclusively in lowland moist forests (Koch et al. 2011; McCranie 2018); however, there are some records in tropical dry forests and riparian forest within pine savannah (McCranie et al. 2006; Bringsøe et al. 2016). Due to the scarcity of records and individuals deposited in museums (Taylor 1956), available information on its natural history appears to be limited; however, important observations have been reported. For example, Meyer and Wilson (1973) described the record of UMMZ 58369 by T. H. Hubbell in a large tree trunk immediately after felling. Bringsøe et al. (2016) observed two males fighting in low vegetation about three meters above the ground. In Honduras, McCranie (2018) mentioned that *P. guttuosus* have been found near the ground and freshly fallen trees, on the main trunks of trees, and alongside riverbanks. Roberts (1997) recorded mating behavior about two meters off the ground and a gravid female in a tree during the month of May. In Honduras, pregnant females were captured in September and November, while juveniles were observed in October (McCranie 2018). Sleeping adults have been observed at a height of 3–5 meters above the ground (Bringsøe et al. 2016; McCranie 2018). McCranie et al. (2006), Bringsøe et al. (2016), Solís et al. (2017) and McCranie (2018) also observed *P. guttuosus* associated with riparian forests.

The conservation status of *P. guttuosus* is potentially inaccurate or with data limited. The International Union for Conservation of Nature (IUCN) considered *P. guttuosus* as Least Concern (Acosta Chaves et al. 2017), possibly a result of its wide distribution. On the other hand, using the Environmental Vulnerability Score (EVS), Johnson et al. (2015) gave a score of 12 (medium vulnerability). Due to its presence in the tropical rainforest canopy, *P. guttuosus*

requires significant forest cover to live and move through the canopy, as is the case with other arboreal vertebrates [see Pough (1980) and Block et al. (1998) for further discussion]. Therefore, *P. guttuosus* is considered sensitive to deforestation; a well-preserved forest is of vital importance for its natural history processes (see McCranie 2018). Herein, we describe a new locality for *P. guttuosus*, which fills a gap within its northernmost distribution; notes on several natural history observations are reviewed and we discuss the conservation of the Berthold's Bush Anole.

Methods

We conducted a week-long field expedition between January and February 2022 to the Wuarska area to carry out annual monitoring of the herpetofauna within the core zone of the RHBRP. In recent decades, Wuarska, core of the RHBRP, was invaded by non-native peoples causing considerable damage to the landscape; even though, agriculture and cattle ranching are not allowed in this world heritage site, these activities led to deforestation (ESNACIFOR 2013; Ávila-Palma et al. 2019). The RHBRP is located between 14.9650°N and 16.0119°N, and 85.5236°W and 84.1922°W, which corresponds to the intersection of the departments of Gracias a Dios, Olancho, and Colón; and includes six Municipalities: the entire Municipality of Brus Laguna and partially the Municipalities of Wampusirpi, Juan Francisco Bulnes (Wualumugu), and Ahuas in the Department of Gracias a Dios; Dulce Nombre de Culmí in the Department of Olancho; and Iriona in the Department of Colón (ESNACIFOR 2013).

During our survey, we found an adult individual of *P. guttuosus* in a riparian forest within the La Carrizalosa stream (Fig. 1) very close to its mouth towards the Wuarska River which connects with the Blanco River to form the beginning of the Platano River. We identified the individual through the taxonomical keys and the morphological description of McCranie (2018). We obtained morphometric measurements using a Truper digital caliper with a precision of 0.01 mm (Table 1). In conjunction with the meristic character count based on the table of Ruiz et al. (2016), we compared our specimen with the description of Koch et al. (2011), and the morphometric data detailed by McCranie (2018). We determined its sex through Nickerson's (1970) method, which consists of checking the presence of the hemipenis by pulling them out of the body. After measurements we preserved the organism in 10% formalin and immersed it in a 70% alcohol solution following McDiarmid et al. (2012). The specimen was deposited in the herpetological collection of the Zamorano Biodiversity Center (CBZ-H), Escuela Agrícola Panamericana Zamorano, Valle de Yeguaré, Francisco Morazán, Honduras. This research was developed as part of the annual biodiversity monitoring stipulated within the Annual Operational Plan (POA) corresponding to the Region de la Biosfera de Río Plátano of the ICF, institution in charge of the co-management of this protected area.



Figure 1. Quebrada La Carrizalosa, near the basin of the Wuarska river, the locality where *Polychrus guttuerosus* was found.

Table 1. Morphometric comparison of the male (CBZ-H-002) of *Polychrus guttuerosus* with the males reviewed by Koch et al. (2011).

Morphometry and meristic characters	Male (CBZ-H-002)	Koch et al. (2011) (n = 10)
Axilla-groin length/SVL	0.60	0.45–0.55 (0.53 ± 0.03)
Tail length/SVL	2.99	3.08–3.55 (3.30 ± 0.16)
Head length/SVL	0.23	0.18–0.25 (0.22 ± 0.02)
Head length/Head width	1.31	0.93–1.56 (1.38 ± 0.20)
Head width/Head height	1.59	0.97–1.34 (1.07 ± 0.13)
Scales around midbody	58	63–75 (68.4 ± 3.27)
Vertebral scales	86	75–93 (84.6 ± 5.56)
Gular scales	22	22–30 (26.9 ± 2.28)
Diameter eye/head length	0.17	0.30–0.49 (0.35 ± 0.05)
Subdigitals finger IV	28	30–36 (33.0 ± 1.94)
Subdigitals toe IV	34	38–44 (41.2 ± 2.15)
Forelimbs/SVL	0.53	0.37–0.54 (0.49 ± 0.04)
Hindlimbs/SVL	0.66	0.56–0.73 (0.63 ± 0.06)
Femoral pores (left)	12	14–19 (15.7 ± 1.49)

Results

An adult male bush anole *Polychrus guttuerosus* (CBZ-H-002; Fig. 2) was found and collected by CAAF and MM on January 30, 2022, at 20:52 h, in La Carrizalosa stream, at the edge of the water body, perching inactively on the end of a leafy branch 1.6 m above the ground and 2.5 m above the water. The locality of the *P. guttuerosus* is within a region known as Wuarska within the core zone of the RHBRP, Municipality of Iriona, Department of Colón, Honduras (15.3342°N, 85.2672°W, datum WGS84; elevation 406 m; Fig. 3).

The specimen has the following measurements (mm): snout-vent length: 118.10; tail length: 353.00; total length: 471.10; head length: 26.90; head width: 20.50; head height: 16.90; hand length: 62.91; foot length: 78.06; axilla-groin length: 71.26; eye diameter: 4.44; weight: 35 g. Most of the morphometric data obtained from our male specimen (CBZ-H-002) detailed in Table 1 agreed with the measurements, counts, and proportions for male specimens reported by McCranie (2018) and Koch et al. (2011), except for the comparisons mentioned in our discussion.



Figure 2. *Polychrus guttuerosus* in-situ, found inactive during the night of 30 January 2022 at 20:52.

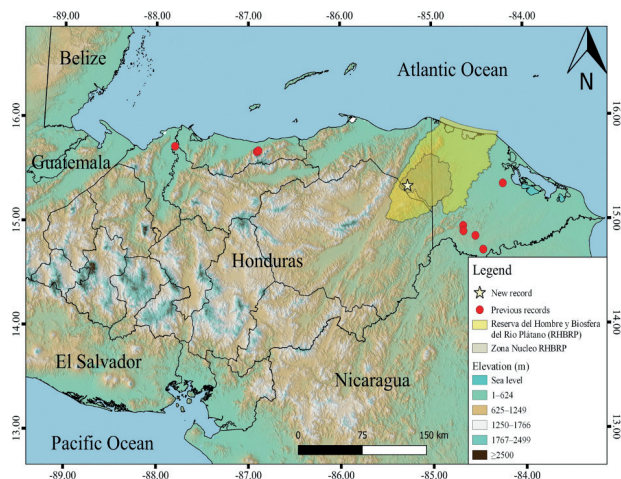


Figure 3. Geographic distribution of the known records of *Polychrus guttuerosus* in Honduras.

Discussion

Our observation on *P. guttuerosus* is the first for the species in the department of Colón, and the first record with verifiable evidence for the RHBRP. This specimen was collected 78 km NW from the nearest locality, Kipla Tingni Kiamp, which is part of the Miskitu territorial council (Honduran Mosquitia) of the Federación de Indígenas Nativos de la Zona de Mocarón - Segovia (FINZ-MOS). Our record fills, in part, a gap of what seemed to be a disjunct distribution for this species in Honduras. Considering the record present herein, the current Honduran distribution of *P. guttuerosus* is in accordance with the map presented by Köhler (2008). We also confirmed the presence of *P. guttuerosus* in the RHBRP, the only site declared by UNESCO (1982) as a Natural World Heritage Site in Honduras. House et al. (2002) included *P. guttuerosus* as part of the herpetofauna for the protected area without any verifiable evidence. The elevation of our record (406 m) is within the 10–410 m known range for Honduras (Solís et al. 2017; McCranie 2018).

The snout-vent length measurement of our male specimen (118.10 mm) is in accordance with the range of 87–122 mm presented by McCranie (2018). The size proportions and morphometric characteristics are within the ranges presented by Koch et al. (2011), excluding the proportions such

as axilla-groin length/snout-vent length and the tail length/snout-vent length which are slightly lower than the known range and the head width/head height which is slightly higher (see Table 1). Morphometric review of our specimen in comparison to Koch et al. (2011) and McCranie (2018), indicates a slightly lower number of scales around the body, and a lower number of subdigitals finger IV and number of femoral pores (see Table 1).

Regarding natural history information, different factors considered important for the selection of roosting perches have been analyzed, these are as follows: physiological aspects such as body temperature during the night and upon returning to activity, voluntary hypothermia to conserve energy; ecological factors such as vegetation structure, predation avoidance, intra- and interspecific competition and biological factors such as species, sex, age, and size (Cabrera-Guzmán and Reynoso 2010; Mohanty et al. 2016; Storks and Leal 2020). Information on natural history including perch height in *P. guttuosus* is scarce. Arguedas et al. (2019) presented preliminary information from Costa Rica and mentioned that there are no differences between males and females regarding sleeping perch height; a negative correlation was found between sleeping perch height and nocturnal skin temperature in females, but not in males. We encourage a proper publication from Arguedas et al. (2019), and additional studies are needed to understand this behavior in *P. guttuosus*.

In addition to the features mentioned above, we consider that the encounter with our specimen of *P. guttuosus* might have been as a result of its nocturnal fall from a treetop, as it was found in a climbing position close to the ground; a similar event was observed on another canopy dweller lizard in Honduras [e.g. *Laemantus julioi*, Antúnez-Fonseca et al. (2021)]. Interestingly, we had examined this same locality for herpetofauna on the afternoon of the same day but did not observe the CBZ-H-002 specimen. We also hypothesized that there might be a relationship between the presence of *P. guttuosus* and bodies of water as our record near the stream La Carrizalosa is in accordance with McCranie et al. (2006), Bringsøe et al. (2016), Solís et al. (2017), and McCranie (2018); water bodies such as rivers and streams may contribute to aspects such as thermo-hydroregulation in individuals (Rozen-Rechels et al. 2019).

The Wuarska forest where we report *P. guttuosus*, presents patches of recovering (~15 years old); before recovery, this area was invaded by non-native people, replacing these forest patches with crops and pastures for livestock (Ávila-Palma et al. 2019). In addition to Martínez et al. (2020) for *Myrmecophaga tridactyla* (Xenarthra) and Ávila-Palma et al. (2019) for *Mimon cozumelae* (Chiroptera), our work highlights the need of a greater sampling effort in the area to continue monitoring and finding rare species. These records may indicate that there is still significant vegetation cover, and that Wuarska is recovering to harbor species rarely detected due to its significant vegetation cover. Species such as *P. guttuosus* are associated with undisturbed forests, although it has also been found in disturbed sites (McCranie et al. 2006). The removal of the land occupied by the invaders may have given time for

the onset of a slow recovery; a result of this may be the observation of species such as those mentioned above, which share specific requirements within undisturbed or seldom disturbed forests (e.g. Vitt et al. 1998; Urbina-Cardona et al. 2006; Medina-Rangel and Cárdenas-Árevalo 2015). We conclude that it is necessary to increase conservation actions within the RHBRP to reduce habitat loss, which is advancing very rapidly, affecting this and many other species that inhabit this important protected area, which is the most biodiverse in the country (see McCranie et al. 2006; Martínez et al. 2020; Turcios-Casco et al. 2020).

Acknowledgements

We dedicate this work to the late Ing. José Alexander González who offered his life for the sake of conservation of the Río Plátano. We thank Esmelyn Guzmán of the Región Biosfera del Río Plátano de ICF for his outstanding assistance throughout the expedition and field-work during which this important record was established. Thanks to Franklin Castañeda and Anthonie Andino for providing access to literature involved in this work. We also extend our gratitude to the collection of the Zamorano Biodiversity Center, EAP, for receiving the specimen. Also to Región Forestal Francisco Morazán and Región Biosfera del Río Plátano of the ICF, and The Big Bat Theory research group for their field assistance. Finally, to the editor and three reviewers who improved this manuscript with their comments and we also wish to thank Lydia Allison Fucsko and Zdravka Zorkova for editing of this paper, which considerably improved it.

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