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A noteworthy observation of *Corallus caninus* (Linnaeus, 1758) within the *Corallus batesii* (Gray, 1860) range in the Central Brazilian Amazonia

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The Emerald Tree Boa, *Corallus caninus* (Linnaeus, 1758), is an almost exclusively arboreal, nocturnally active snake, endemic to South America (Henderson, 1993). It inhabits mainly lowland tropical rainforest habitats, although it might also be found in forested areas of Cerrado and gallery forests associated with seasonally flooded grassland (Henderson et al., 1995, 2009). It exhibits a distinct ontogenetic colour dimorphism, as juveniles' dorsal ground colouration is yellow, brick red-brown, and rarely green, while adults are almost invariably green (Henderson, 1993; Henderson et al., 2009). For a long time, all populations throughout the vast range of the Emerald Tree Boa were considered to belong uniquely to *C. caninus* (Henderson, 1993). However, based on mitochondrial DNA sequence differences (Vidal et al., 2005) and on the distinct morphological differences (Henderson et al., 2009), populations south of the Rio Amazonas and west of the Rio Negro were determined as *Corallus batesii* (Gray, 1860), a valid senior taxon, which was revalidated (Henderson et al., 2009). Therefore, *C. caninus* distributes throughout the Guyana, Suriname, French Guiana, eastern and southern Venezuela (states of Bolívar and Amazonas), and northeastern Brazil north of the Rio Amazonas and north and east of the Rio Negro (in the states of Amapá, Pará, Roraima, and Amazonas), at elevations between 0–200 m (Henderson et al., 2009; Nogueira et al., 2019). *Corallus batesii* is distributed north and south of the Rio Amazonas west of the Rio Negro in Brazil, in Amazonian Colombia, Ecuador, Peru, and Bolivia, as well as in northwestern Colombia north of the Andes, at elevations between 0–1000 m elevation (Henderson et al., 2009; Nogueira et al., 2019). Moreover, due to the strong mtDNA sequence divergence between populations from Peru and the rest of the populations, which morphological differentiation fails to reflect, *C. batesii* might potentially be a species complex (Henderson et al., 2009). Here, we report on the presence of *C. caninus* within the former known range distribution of *C. batesii*, from the southern bank of the Rio Negro.

Field surveys were carried out on two consecutive nights on 20 and 21 October 2023 in an area between Cacau Pirera and Vila de Paricatuba, situated next to a gulf on the southern bank of the Rio Negro, 12 km south-west from the city of Manaus, Amazonas, Brazil (3.1321°–3.1404°S, 60.1806°–60.1841°W, elevation 30–60 m) (Fig. 1). The site consists of secondary tropical rainforest. It was surveyed on foot between 19:30 and 03:00 h by three persons. Coordinates were taken with a Garmin eTrex 20 GPS to the nearest 5 m.

Species identification was based on the combination of the two main (1 and 2) and one secondary (3) morphological traits, considered as species specific: 1) presence / absence and number of lateral blotches – absent or very few in *C. caninus* (0–11, mean ± SD = 1.3 ± 2.7), rarely absent and usually with high number in *C. batesii* (0–38, mean ± SD = 18.1 ± 8.2); 2) number of scales across the snout at the level of the suture between the third and fourth supralabials – reduced number in *C. caninus* (2–6, mean ± SD = 3.4 ± 1.1), a high number in *C. batesii* (3–12, mean ± SD = 6.9 ± 1.6); and 3) presence or absence of mid-dorsal longitudinal stripe – absent in *C. caninus* and present or absent in *C. batesii* (Henderson et al., 2009).

Data for the published locations were obtained by: 1) exact coordinates, as provided in the respective publications (Maschio et al., 2016; Frazão et al., 2020); 2) approximate coordinates, derived from location descriptions in the respective publications (Vidal et

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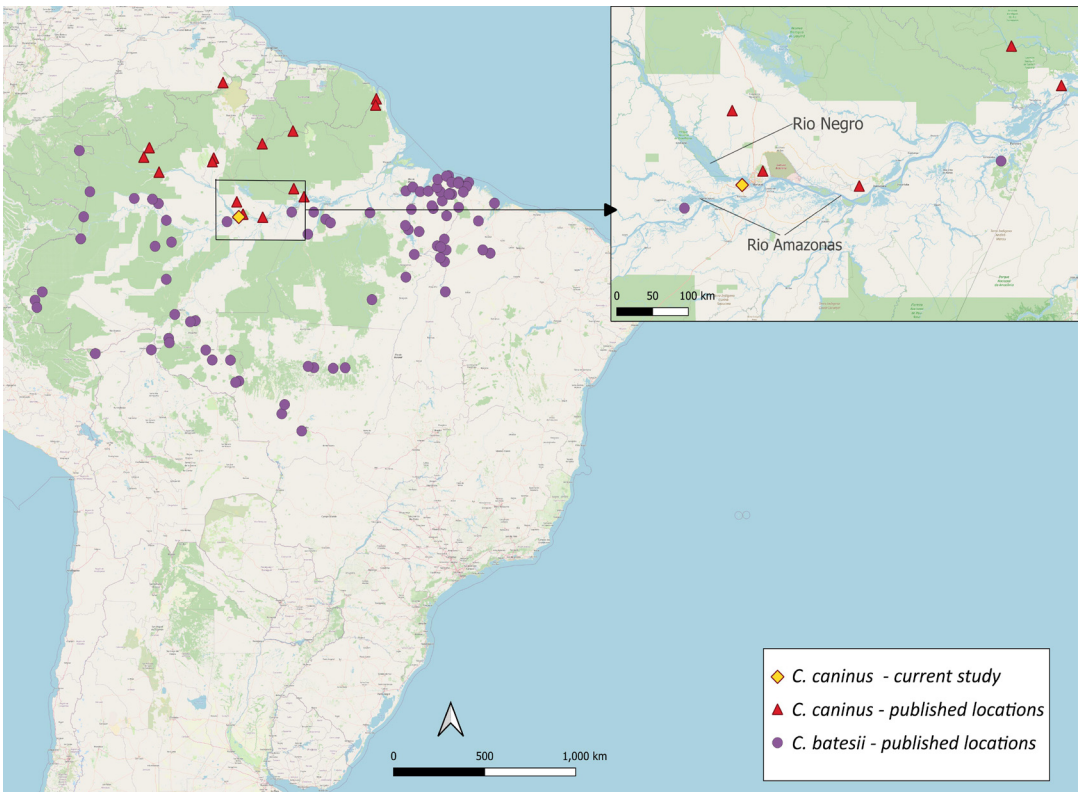

Figure 1. Distribution map of *Corallus caninus* and *C. batesii* in Brazil, highlighting the new location reported in this study along with the previously published locations, listed by Vidal et al. (2005), Henderson et al. (2009), de Fraga et al. (2013), Maschio et al. (2016), Nogueira et al. (2019) and Frazão et al. (2020).

al., 2005; de Fraga et al., 2013); and 3) approximate coordinates, obtained by georeferencing maps in the respective publications (Henderson et al., 2009; Nogueira et al., 2019). Georeferencing was done in QGIS 3.38.3 (QGIS Development Team 2019) with an accuracy of ± 500 m. Locations located close to each other were georeferenced by crossing two or more lines to find a centre. Data from the map in Henderson (1993) were not included, since this publication predates the separation of the two species and all locations are presented as belonging to *C. caninus*. Because there is no available data in Henderson (1993) on the morphological characteristics of the specimens from individual locations, identifying which species corresponds to each location would be unreliable, at least for the locations situated near the Rio Amazonas and Rio Negro. Data from the Global Biodiversity Information Facility (GBIF, 2024a) that are not published in the scientific literature were also not included because often it is not possible to confirm the correct identification of the species and/or the accuracy of the presented coordinates and locations.

An adult individual of *C. caninus* was found in the surveyed site (3.1383°S, 60.1808°W, elevation 60 m) at 23:40 h on 21 October 2023, approximately 1.7 km south-west from the main current of the Rio Negro. It was hanging upside down from a small branch, with its head situated approximately 50 cm above the ground (Fig. 2A). The specimen was visually estimated to be approximately 100 cm in length. Notably, it exhibited an absence of lateral blotches and a prominent mid-dorsal longitudinal stripe (Fig. 2A), and was characterised by the presence of five scales across the snout at the level of the suture between the third and fourth supralabials (Fig. 2B). The snake was briefly photographed *in situ*, without capture or handling, and subsequently left undisturbed. This location is situated approximately 30 km south-west of the nearest published site for *C. caninus* and 80 km north-east of that for *C. batesii* (Fig. 1).

Figure 2. Photographs of the individual *Corallus caninus* observed on 21 October 2023, 1.7 km south-west from the Rio Negro. (A) View of the snake's body pattern, highlighting the absence of lateral blotches and a mid-dorsal longitudinal stripe. (B) View of the snake's head, showing the five scales (indicated with red dots) across the snout at the level of the suture between the third and fourth supralabials. Photos by Angel Dyugmedzhiev.

As demonstrated by the findings of Henderson et al. (2009), the morphological differentiation between *C. caninus* and *C. batesii* is not entirely categorical, as there is a certain degree of variation and overlap in morphological traits between the species. However, these variations and overlaps appear to be infrequent and regionally specific. For instance, specimens of *C. batesii* exhibiting either an absence of or very few white lateral blotches and lacking a mid-dorsal stripe have been documented exclusively from the states of Mato Grosso and Rondônia in the western Amazon of Brazil (Vidal et al., 2005; Henderson et al., 2009). Therefore, based on this information, along with the observation that each of the three morphological features of the individual reported herein is characteristic of *C. caninus*, misidentifying this individual is unlikely.

Even though our record is near previously reported sites (de Fraga et al., 2013) and does not significantly extend the species range in a broad sense, it remains of particular interest because it lies outside of the assumed range of *C. caninus* and within that of *C. batesii* (Henderson et al., 2009; Nogueira et al., 2019). Henderson et al. (2009) assumed that the Rio Negro, and likely the Rio Amazonas as well, might not constitute insurmountable barriers to cross-river dispersals between the two species and therefore might be an insufficient barrier to consistently prevent gene flow between their populations. This assumption has also been made for various species of birds and mammals (Capparela, 1991; Ayres and Clutton-Brock, 1992; Patton and da Silva, 1998; Borges, 2007). Our observation shows that at least some individuals of *C. caninus* were able to cross the Rio Negro, either naturally or unnaturally (e.g., by human transport). However, a single observation is insufficient to either confirm or reject the assumption of Henderson et al. (2009), so further studies are needed to validate it. The relatively close proximity between the location of *C. caninus* reported in the current study and the nearest published location for *C. batesii* (approximately 3.4217°S, 60.9085°W, Henderson et al., 2009) might indicate the existence of a contact zone between the two species in the Central Amazon

Basin, situated between the south-western banks of the Rio Negro and the northern banks of Rio Amazonas. However, this area remains poorly studied, as indicated by the almost complete lack of published data on either species, which are quite difficult to find in nature (Fig. 1). The remoteness and the poor accessibility of many areas in the Amazon region often make in-depth research challenging and expensive. Notably, observations of individuals from either species within this area, especially those made by non-professional herpetology enthusiasts, might be unreported in the scientific literature and, thus, remain unknown. For instance, a check of the Global Biodiversity Information Facility database (GBIF, 2024a) revealed three records of individuals identified by observers as *C. caninus* within the *C. batesii* range, for which photographs of the observed animals were available. Two of those records – an adult and a juvenile situated less than 2 km from each other – are approximately 80 km south from Rio Amazonas in the state of Pará, northern Brazil (3.1773°S, 54.8307°W, elevation 149 m and 3.1611°S, 54.8359°W, elevation 92 m, respectively). The adult individual (GBIF, 2024b) lacks any lateral blotches and a mid-dorsal longitudinal stripe. It has a few scales across the snout at the level of the suture between the third and fourth supralabials, although their exact number cannot be determined with certainty due to the low quality and the perspective of the available pictures in the dataset. The juvenile (GBIF, 2024c) lacks a mid-dorsal longitudinal stripe and exhibits many lateral blotches. It also has a few scales across its snout, although the exact count of these features cannot be determined due to the quality and the perspective of the available pictures in the dataset. The third record is of an adult individual located approximately 16 km to the south-west of the Rio Negro in the state of Amazonas (2.9050°S, 60.8786°W, elevation 61 m; GBIF, 2024d), and approximately 82 km north-west from the location, reported in our study. This individual lacks any lateral blotches and a mid-dorsal longitudinal stripe. However, it appears to have a high number of scales across the snout, though the exact count cannot be determined due to the perspective of the available pictures in the dataset. Given the inability to obtain precise morphological features of these three individuals from the available images, and the possibility that at least two of them may exhibit mixed traits from both species, their species affiliation cannot be confirmed with certainty. However, these records, along with the observation reported here, highlight the need for further research into the true ranges of *C. caninus* and *C. batesii*, as well as the potential existence of contact zones and the presence/absence of gene flow between them. According to Colston et al. (2023), the species status of *C. batesii* and the divergence times from *C. caninus* need further investigation. Therefore, more detailed studies in this potential contact zone are highly needed in order to fully assess these aspects of the species taxonomy. Consequently, the observation reported here might serve as a baseline to encouraging future reports and studies on the distribution patterns of *C. caninus* and *C. batesii* in the Central Amazon Basin.

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