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First records of the rare snake *Echinanthera cephalomaculata* Di-Bernardo, 1994 in the state of Pernambuco, Brazil (Serpentes: Dipsadidae)

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The Atlantic rainforest is one of the most biodiverse tropical forests, as well as the most threatened biome in the world (Myers et al., 2000). The Pernambuco Endemism Center (CEP) comprises the northern portion of the Brazilian Atlantic Rainforest, delimited from the north of the São Francisco River to the southern region of the state of Rio Grande do Norte, with a considerable number of animal and plant species occurring only in this short and extremely fragmented and threatened forest stretch (Tabarelli and Santos, 2004).

Five snake species threatened with extinction at the national level occur in the CEP: *Amerotyphlops amoipira* (Rodrigues and Juncá, 2002), *Atractus caete* Passos, Fernandes, Bérnils and Moura-Leite, 2010, and *Bothrops muriciensis* Ferrarezzi and Freire, 2001 in the "endangered" category, and *Amerotyphlops paucisquamus* (Dixon and Hendricks, 1979) and *Echinanthera cephalomaculata,* both as "vulnerable" (MMA, 2014; Roberto et al., 2017).

The state of Pernambuco published a list of endangered reptile species in 2017, comprising eight snake species (SEMAS, 2017): *Bothrops bilineatus* (Wied, 1821) (vulnerable); *Dipsas sazimai* Fernandes, Marques, and Argôlo, 2010 (vulnerable); *Drymoluber dichrous* (Peters, 1863) (vulnerable); *Erythrolamprus reginae* (Linnaeus, 1758) (vulnerable); *Lachesis muta* (Linnaeus, 1766) (vulnerable); *Rodriguesophis iglesiasi* (Gomes, 1915) (endangered); *Siphlophis compressus* (Daudin, 1803) (vulnerable); and *Xenopholis scalaris* (Wucherer, 1861) (vulnerable).

The genus *Echinanthera* comprises six species known to occur in the Atlantic rainforests of Brazil (Di-Bernardo, 1992; Myers and Cadle, 1994; Costa and Bérnils, 2018). The genus comprises small to medium-sized (<1.2 m) aglyph snakes with diets based on ectothermal prey (Moura-Leite et al., 2003; Marques et al., 2004; Pontes and Rocha, 2008; Santos-Jr., 2009; Salles and Silva-Soares, 2011; Gomes, 2012). Some species belonging to this genus, such as *E. amoena* (Jan, 1863) and *E. cephalomaculata*, are poorly known, with few specimens in zoological collections and few available natural history data (Azevedo et al., 2018). In this context, *E. cephalomaculata* raises the most concerns.

Echinanthera cephalomaculata was described based on only two individuals collected in the beginning of the 1990s in the municipality of Quebrangulo, state of Alagoas, northeastern Brazil (Di-Bernardo, 1994). More specifically, its type locality is the Pedra Talhada Biological Reserve, an Atlantic rainforest remnant in northeastern Brazil, inserted in the border of the Borborema Plateau, with elevations ranging from 500 to 1,197 meters above sea level (asl). After over 20 years without any records, two *E. cephalomaculata* specimens were observed again at the Pedra Talhada Biological Reserve, both moving in the middle of the forest, at

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560 and 850 m of elevations (Roberto et al., 2015). This study reports three *E. cephalomaculata* records for the state of Pernambuco, expanding the species distribution in about 150 km to the northeast from its type locality (Fig. 1).

The *E. cephalomaculata* records compiled herein come from different sources, applying an unusual approach in science, but which can be potentially useful (see below). The PhD project of the first author (MAF) includes furthering knowledge on the reproductive biology of anuran amphibians in three high areas in the state of Pernambuco, in addition to obtaining general herpetofauna knowledge in these areas. Part of the data comes from information exchanges with local residents and professionals from the environmental area who have been informed about the purposes of the project and the importance of snake´s conservation through lecture circuits conducted by the first author over the years. This integrative approach between society and academic community resulted in constant calls for snake rescue or identification of snakes occasionally encountered by locals. The three *E. cephalomaculata* records presented below were obtained through *in situ* photographs sent to the first author of this study by amateur herpetologists.

The first record (Fig. 2A) was obtained by Gessica Gomes Barbosa on the 12th of February 2019 at the Tao Farm locality, a private reserve in the municipality of Gravatá (8.2822° S, 35.5752° W; Datum WGS84; 750 m elevation). The snake was observed at 1400 h moving inside a densely forested area of about 40 hectares (Fig. 2B). The second record (Fig. 2C) was obtained by João Domingos Pinheiro Filho on the 17th of April 2019 at 1200h, in the Municipal Natural Park Professor João Vasconcelos Sobrinho (8.3625° S, 36.0316° W; Datum WGS84; 850 m elevation), located within municipality of Caruaru. This ecological reserve constitutes an Atlantic rainforest fragment comprising 359 hectares (Fig. 2D). The third record (Fig. 2E) was obtained by Karol Priscila Bernardino on the 4th of July 2019 at the municipality of Chã Grande, at the private property of Amorinha (8.3222° S, 35.5119° W; Datum WGS84; 403 m elevation). The specimen was found around 1000 h, during the mowing of an anthropized forest fragment of about 10 hectares (Fig. 2F).

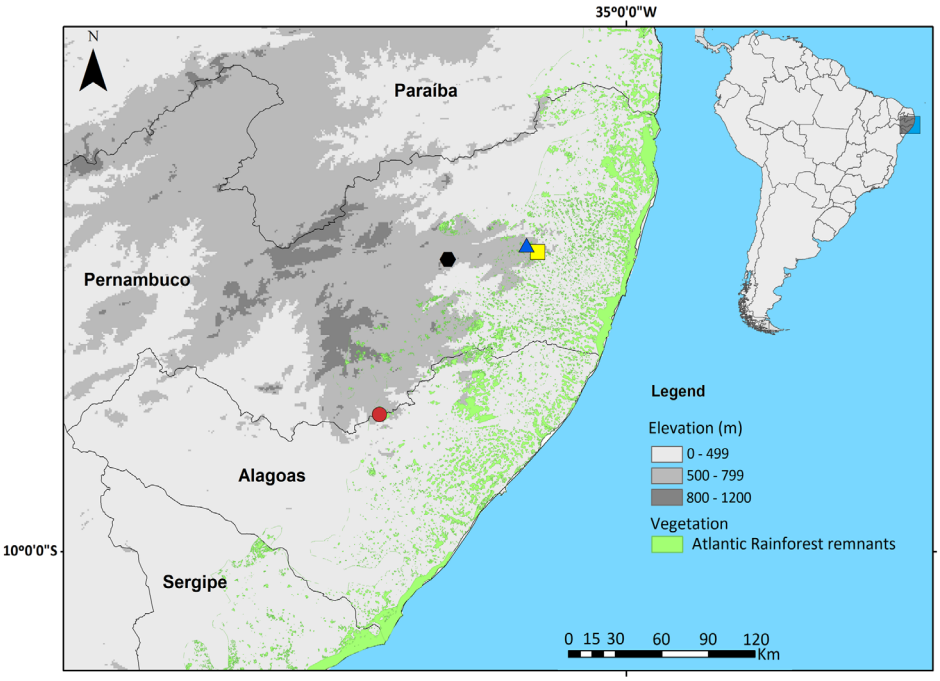

Figure 1. *Echinanthera cephalomaculata* distribution in northeastern Brazil. Red circle = type locality, Pedra Talhada Biological Reserve, municipality of Quebrangulo, state of Alagoas; black hexagon = Municipal Natural Park Professor João Vasconcelos Sobrinho, municipality of Caruaru, state of Pernambuco; blue triangle = Tao Farm, municipality of Gravatá, state of Pernambuco; yellow square = Amorinha locality, municipality of Chã Grande, state of Pernambuco.

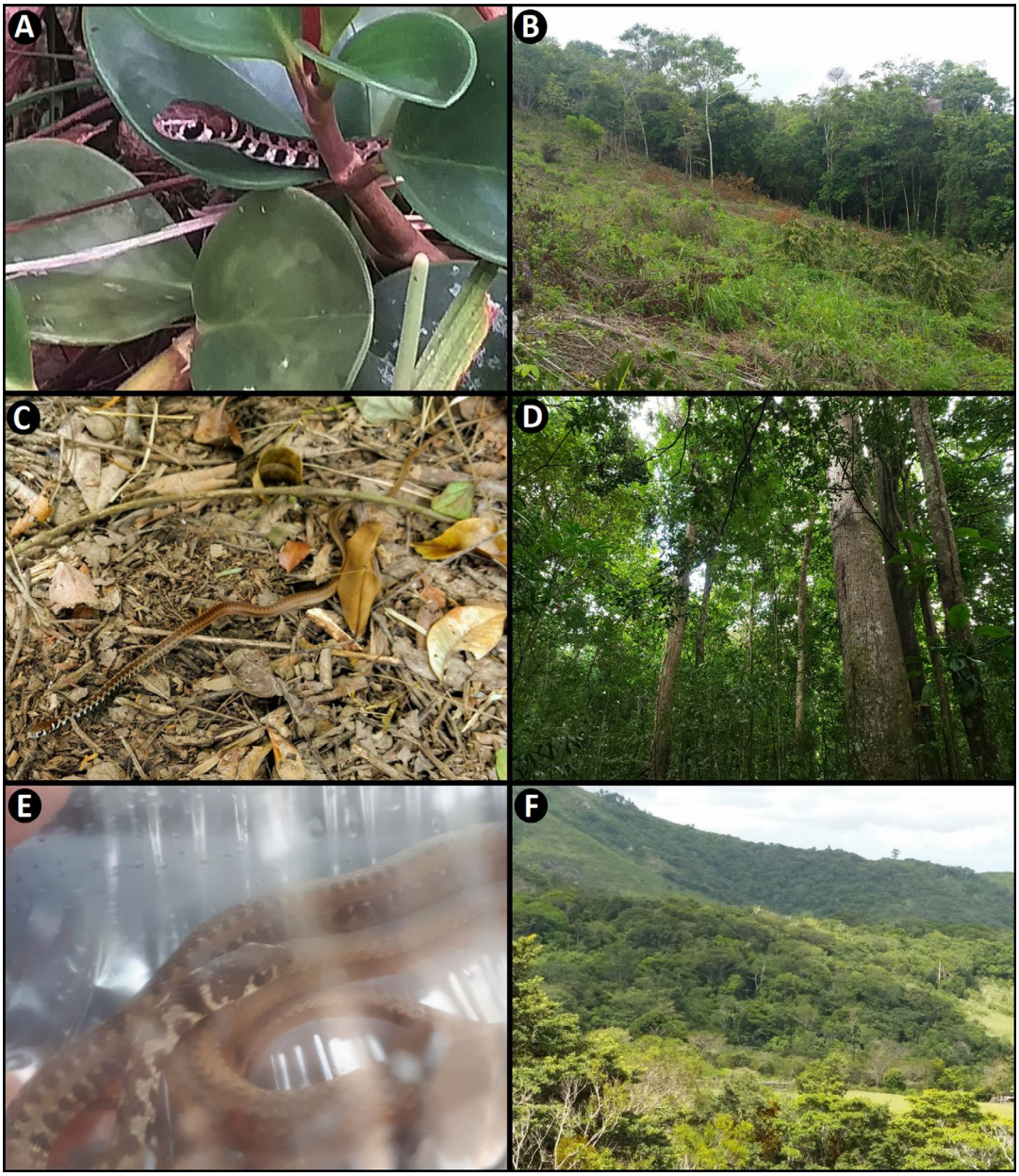

Figure 2. First records for *Echinanthera cephalomaculata* in the state of Pernambuco, Brazil. Specimens (left column) and their occurrence localities (right column): (A–B) Specimen from Tao Farm, in the municipality of Gravatá; (C–D) Specimen from Municipal Natural Park Professor João Vasconcelos Sobrinho, in the municipality of Caruaru; (E–F) Specimen from locality Amorinha, in the municipality of Chã Grande.

The importance of scientific collections as a tool for understanding biodiversity has been a frequent theme for the lectures promoted during the PhD project of the first author of this study. This approach has had a significant impact on the area as local people began recording herpetofauna through photographs and, eventually, collecting specimens that were found dead. For legal reasons (absence of collection permits) and

potential risk to human health (possibility of snakebite accidents), the collection of living snakes was markedly discouraged during our environmental education activities. Therefore, our records of *E. cephalomaculata* specimens—all observed in life—are restricted to photographs. In the first and second records, the specimens were photographed and allowed to go away. In the third record, the specimen was captured, photographed and taken to another nearby forest fragment.

Conflicting opinions in the literature regarding photograph-based taxonomy are noted. Basically, one research line favours the use of photographs as an efficient tool for taxa description and characterization (Pape et al., 2016), while another argues that this would be an inadequate and potentially harmful process to the biological sciences (Ceríaco et al., 2016). In particular, we agree with the latter. The absence of specimens in zoological collections increases taxonomic instability and imprecision and should, therefore, be avoided. However, we decided to make an exception in the present study, due to the importance of the described records and the real possibility of unambiguous identification of the assessed taxon through the analysed photographs.

Di-Bernardo (1994) defined the *E. cephalomaculata* diagnosis as follows (as translated from Portuguese by us): "*Echinanthera cephalomaculata*, sp. n. differs from all other species belonging to the genus by displaying a large white macula around the eyes (except superiorly), which contrasts with the dark coloration of the supra and laterocephalic regions, and by presenting a series of dark quadrangular bars arranged paraventrally, from the beginning towards the end of the first third of the trunk". These characteristics are easily observable in the individuals represented in the three photographs and unambiguously distinguish *E. cephalomaculata* from other Dipsadidae snakes. In addition, the specimens observed in photographs 1C and 1E, display the pair of white ocelli on the parietal shells, a characteristic widely distributed throughout the Echinantherini tribe (Santos-Jr., 2009; ADA, pers. obs.), which is not shared by sympatric species with relatively similar external morphology as, for example, *Erythrolamprus almadensis* (Wagler, 1824).

The records presented herein agree with the terrestrial habits suggested for *E. cephalomaculata* (Di-Bernardo, 1994; Roberto et al., 2015), and provides evidence of diurnal activity for this species. In fact, the habits of almost all species belonging to the *Echinanthera* genus seem to be related to activities carried out on the forest litter (except for *E. amoena*; see Azevedo et al., 2018). Additionally, we provide the first *E. cephalomaculata* records outside its type locality, and the first for the state of Pernambuco, extending the species distribution approximately 150 km to northeast. With these records, seven known records of this species are noted, in four areas of occurrence. Among these areas, three (Pedra Talhada Biological Reserve, Municipal Natural Park Professor João Vasconcelos Sobrinho, and Tao Farm) consist on conserved forests at elevations above 600 m. In contrast, the record from Amorinha, in the municipality of Chã Grande, was obtained in a degraded area, about 400 m elevation. However, the existence of some forest remnants close to this area makes it impossible to predict if *E. cephalomaculata* exhibits a certain amount of plasticity in degraded habitats or if this record constitutes a fortuitous event of a specimen dispersed from a well-preserved forest remnant.

The new *E. cephalomaculata* records, although encouraging, confirm an obscure outlook for the species. Martins et al. (2016) considered *E. cephalomaculata* in the Vulnerable category (VU) regarding risk of extinction in national territory. As argued by these authors, the only known record at the time of publication (Pedra Talhada Biological Reserve) is inserted in a widely impacted region, with few native vegetation remnants and increasingly under pressure from agricultural activities (Tabarelli and Santos, 2004). The authors also predicted that, given the extensive historical and recent degradation of the area of occurrence for *E. cephalomaculata*, subpopulations of this species would probably be reduced to small fragments subject to small-scale anthropic alterations that could, in the short term, lead to higher risks of extinction. This prediction was confirmed herein, especially through the record obtained at the municipality of Chã Grande, where a specimen was found exactly during a native forest cut.

On the other hand, the new records presented herein open interesting future perspectives. The finding of a specimen within a Conservation Unit (at the Municipal Natural Park Professor João Vasconcelos Sobrinho) should be highlighted. This record motivated the beginning of a detailed inventory of the composition and richness of reptile species at this park. As a result, we hope that the additional *E. cephalomaculata* specimen findings will support an integrative approach in obtaining population abundance, natural history, morphological and genetic variations and phylogenetic position data on this rare species.

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