First record of *Lithodytes lineatus* (Schneider, 1799) (Anura: Leptodactylidae) in the state of Tocantins, ecotone zone Amazon-Cerrado biomes, with notes on its natural history

Carlos Eduardo Domingos Cintra¹*, Helder Lúcio Rodrigues da Silva² and Nelson Jorge da Silva Junior¹

*Lithodytes* Fitzinger 1843 is a monotypic genus that was recently removed from the synonymy of *Leptodactylus* by Pyron and Wiens (2011) and proposed as sister taxon of the genus *Adenomera*. The genus is represented only by the species *Lithodytes lineatus* (Schneider, 1799). This species is characterized by its finely spiculated dorsal skin and dark brown coloration, in addition to pale yellow dorsolateral bands that extend from the snout to the flanks (Lescure and Marty, 2000). The ventral surface is smooth, colored brownish grey with cream spots, including large orange spots on the groin and hidden regions of the thighs (Rodriguez and Duellman, 1994). *Lithodytes lineatus* inhabits the leaf litter of forests, where adults are often associated with nests of leafcutter ants (*Atta* sp.; Schlüter and Gullies, 1981). Males are often found vocalizing in underground tunnels of these nests, and were also observed vocalizing in pairs with their noses at the ready. This behaviour is apparently unique to this species (Lamar and Wild, 1995). Spawning takes place in ponds and temporary pools. Foam nests containing eggs without pigment are deposited, which subsequently give rise to tadpoles displaying pinkish colour interspersed by scattered small melanophores and depigmented fins (Lamar and Wild, 1995).

The distribution of *L. lineatus* currently includes the Amazon forest of Bolivia (De La Riva et al., 2000), Colombia (Lamar and Wild, 1995; Lynch, 2005), Ecuador (Rodriguez and Duellman, 1994), Guyana (Lescure and Marty, 2000), Peru (Schlüter, Icochea and Perez, 2004; Duellman, 2005) and Venezuela (Señaris, La Marca and Molina, 2002). Recently, occurrence in Surinam was confirmed by Ouboter and Jairam (2012). In Brazil, this species has been recorded in the Amazon Rainforest of the states of Acre (Bernarde, Machado and Turci, 2011), Amazonas (Lima et al., 2006; França and Venâncio, 2010; Prudente et al., 2013;), Pará (Caldwell and Araújo, 2005; Avila-Pires, Hoogmoed and Rocha, 2010), Rondônia (Bernarde, 2007; Bernard and Kokubum, 2009;), Mato Grosso (de Sá, Heyer and Camargo, 2005) and is also presumed to occur in Amapá (Figure 1).

During field work in the city of Filadélfia, near the Tocantins river, Tocantins state (Figure 1), we collected 18 specimens of *Lithodytes lineatus*, with 17 specimens captured in pitfall traps (-7.720007°S, -47.831703°W) and one specimen captured in a Minow trap (-7.718091, -47.831772°W) (Figure 2). The traps were installed in a phytophysiognomie known as vereda (*sensu* Ratter, 1997), in the Cerrado biome. The specimens were collected between 20 January 2009 and 8 February 2010, and among the 18 specimens, 12 juveniles were collected between the months of November and February. Table 1 shows the age range of the specimens and their respective collection dates. These specimens of *L. lineatus* fully agree with the diagnosis presented by Lescure and Marty (2000), and with analysed specimens of *L. lineatus* (CEPB 195-200) deposited in the collection of the Centro de Estudos e Pesquisas Biológicas (CEPB) of the Pontifícia Universidade Católica de Goiás (PUC Goiás). Two specimens (MPEG 28000 - 28001 MPEG) (Figure 2A and B) were deposited at the herpetological

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collection of Museu Paraense Emilio Goeldi (MPEG). The remaining specimens were released near the capture site after biometric data were recorded.

This is the first record of *L. lineatus* both within the state of Tocantins and in the Cerrado biome, which is located at 475 km from the eastern limit of the known distribution suggested by the IUCN map for this species (Figure 1). The presence of this typical Amazonian species in the study area seems to be associated with forested habitats (gallery forests and veredas), and confirms the importance of these environments in dispersal processes between the Amazon and Cerrado ecosystems (Ávila and Ferreira, 2004). This observation is supported by the sympatric occurrence of the following amphibian species: *Rhaebo guttatus*, *Dendropsophus leucophyllatus*, *Hypsiboas boans*, *Hypsiboas multifasciatus*, *Osteocephalus taurinus* and *Phyllomedusa hypochondrialis* (Figure 3). These species are also mentioned to occur in both the Amazon and Cerrado domains by Valdujo et al. (2012), and were previously reported for this area by Brasileiro et al. (2008). Furthermore, recent records of amphibians assumed to be endemic to the Amazon (e.g. *Pipa pipa* and *Lithobates palmipes*) found in areas of Cerrado (Vaz-Silva and Andrade, 2009; Oliveira, Maciel and Vaz-Silva, 2010) also corroborate this hypothesis.

Among the defence strategies known for *L. lineatus*, two are commonly reported. The first comprises...
Aposematic Batesian mimicry of juvenile specimens (coupled with diurnal activity) of the poisonous anurans *Allobates femoralis* (Figure 4A) and *Ameerega picta*; these species are characterized by dark brown dorsal coloration with a yellow dorsolateral bands, extending from the snout to the flanks, and large orange spots on the groin and hidden regions of the thighs. (Figure 4B) (Lamar and Wild, 1995; Vences et al., 2003). The second strategy reported by Nelson and Miller (1971) comprises the potential to produce skin secretions, judging from granular tubercles on the dorsal surface. This information seems to be derived from the observations of Schlüter, Löttker and Mebert (2009) which reported that all the specimens of *L. lineatus* caught at the entrance of *Atta* sp. nests release an aromatic odour. These authors also suggested that this could be a disguise or chemical repellent to avoid ants, which usually attack and try to kill intruders.

### Table 1. Age range of the specimens *L. lineatus* and their respective collection dates.* = released specimens.

<table>
<thead>
<tr>
<th>Collecting dates</th>
<th>Field Number</th>
<th>Voucher</th>
<th>Range age</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.01.09</td>
<td>2190-INV</td>
<td>MPEG 28000</td>
<td>Adult</td>
</tr>
<tr>
<td>21.01.09</td>
<td>2251-INV</td>
<td>MPEG 28001</td>
<td>Adult</td>
</tr>
<tr>
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<td>2252-INV</td>
<td></td>
<td>Juvenile</td>
</tr>
<tr>
<td>22.01.09</td>
<td>2285-INV</td>
<td></td>
<td>Juvenile</td>
</tr>
<tr>
<td>22.01.09</td>
<td>2291-INV</td>
<td></td>
<td>Juvenile</td>
</tr>
<tr>
<td>25.01.09</td>
<td>2512-INV</td>
<td></td>
<td>Adult</td>
</tr>
<tr>
<td>18.11.09</td>
<td>9077-INV</td>
<td></td>
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</tr>
<tr>
<td>19.11.09</td>
<td>9120-INV</td>
<td></td>
<td>Adult</td>
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<tr>
<td>19.11.09</td>
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</tr>
<tr>
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</tr>
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<td></td>
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</tr>
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<td>05.02.10</td>
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<tr>
<td>07.02.10</td>
<td>10422-INV</td>
<td></td>
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<tr>
<td>07.02.10</td>
<td>10423-INV</td>
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<tr>
<td>07.02.10</td>
<td>10444-INV</td>
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<td>07.02.10</td>
<td>10445-INV</td>
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</tr>
<tr>
<td>08.02.10</td>
<td>10470-INV</td>
<td></td>
<td>Juvenile</td>
</tr>
</tbody>
</table>

*Figure 2. Specimens of *Lithodytes lineatus* from Filadélfia, state of Tocantins, collected in a pit-fall trap (MPEG 28000) (A), and collected in a Minow trap (MPEG 28001) (B). Dorsal (C) and ventral (D) coloration pattern. Photos by Itamar Jr. Tonial.*
We also propose deimatic behaviour of L. lineatus as a third defence strategy. This defensive behaviour consists in lowering the head and lifting the rear of the body, by stretching the legs vertically. The position probably makes the head less vulnerable and may expose the aposematic colouring of the inner surfaces of the thighs to the predator (Figure 4C). In addition, the nictitating membrane may be closed during such deimatic behaviour for protection (Figure 4D). This behaviour agrees with the description denominated ‘Body-raising’, proposed
by Toledo, Sazima and Haddad (2011), which has been observed in several South American leptodactylids, such as *Leptodactylus mystacinus* (Carvalho, 2005), *Leptodactylus pentadactylus* (Villa, 1969), *Pleurodema brachyops* (Martins, 1989) and *Physalaemus deimaticus* (Sazima and Caramaschi, 1986).

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**References**


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