Is it a bird, is it a frog or a bush cricket?
On an enigmatic nocturnal calling song recorded at different locations in southern Bahia, Brazil

(Orthoptera, Tettigoniidae, Paracycloptera grandifolia)

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During fieldwork undertaken over the last ten years targeting amphibian inventories at different areas in the Atlantic Forest (municipalities: Almadina, Amarosa, Arataca, Barro Preto, Camacan, Guaratinga, Itapirú, Ilhéus, Itamaraju, Itarantim, Potiraguá and Wenceslau Guimarães) in Southern Bahia in Brazil, our team registered an enigmatic vocalization. The sound echoed loudly inside forests, reminding the whistle of a traffic police officer. The sound was emitted always from the same locations in the canopy, and most of the time we had the feeling that the vocalization were coming from inside big bromeliads. These characteristics led us to consider that the sound could be emitted by an amphibian belonging to the genus Phyllodytes Wagler (Hylidae). The genus Phyllodytes comprises eleven described species; six of them can be found in southern Bahia (Frost 2016). This diversity is certainly underestimated given the large number of unidentified species.
belonging to this genus which were mentioned in inventories published recently from the region (Dias et al. 2014a,b). The species belonging to this genus use bromeliads during all their life cycles (Peixoto 1995). While this peculiar behavior may be a facilitator to locate species inhabiting soil bromeliads as *Phyllodytes luteolus* (Wied-Neuwied), it mostly hampers detectability as most species use arboreal bromeliads located at more than five meter height (Caramaschi et al. 2004).

During our several frustrated attempts to capture the animals which were producing those sounds, we noted that the individuals did not change the place where they were, not even with the noise done by our team, neither during the attempts to climb the tree to bring the bromeliad down. Most of the time, the sound continued being emitted from the same place. Therefore we discarded the hypothesis that the source of the sound could be a bird, which probably would have taken flight due to the disturbance caused by us.

We still considered two other options: It could be an enormous insect able to emit very loud stridulations, or a frog belonging to a species with an undescribed advertisement call or even an undescribed species. One of the facts that led our team to suppose that we could be dealing with an amphibian was the spectral characteristics of the sound, which were recorded in two populations (Uruçuca and Santa Teresinha) with a Sennheiser ME45 microphone and a Marantz PMD 660 recorder and a Tascam DR-1 recorder. The recordings were analyzed using the software Raven Pro 1.4. The call (n = 40) lasts between 0.5–1.3 seconds and consists of 7–18 (12 ± 4.1) groups of pulses and most of the times 2 to 4 (1–11) repetitions are emitted in sequence. The interval between calls emitted in a series is 0.462–1.034 s (0.673 ± 0.17). The dominant frequency is of about 3 kHz (2.62–3.27 kHz) (Fig. 1; Table 1). Most frequencies emitted by insects are higher and start at about 5 kHz (Montealegre-Z 2009).

Each group of pulses is frequency modulated, with an upward trend in the beginning and a downward trend at the end, thus forming a series of inverted “V”s in the sonogram (Fig. 1), which are not common in amphibian calls. Six harmonic

Table 1. Acoustic parameters of the song of *Paracycloptera grandifolia* from two localities (Uruçuca and Serra da Jibóia) both in Bahia state, Brazil. Recordings are available on Orthoptera Species File Online (Eades et al. 2016). Mean ± standard-deviation and range in parentheses.

<table>
<thead>
<tr>
<th>Call parameters</th>
<th>Serra da Jibóia (n = 20)</th>
<th>Uruçuca (n = 20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration (s)</td>
<td>1.11 ± 0.14 (0.84–1.29)</td>
<td>0.56 ± 0.03 (0.497–0.622)</td>
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<tr>
<td>Dominant frequency (kHz)</td>
<td>3.2 ± 0.1 (2.7–3.2)</td>
<td>2.9 ± 0.1 (2.6–3.0)</td>
</tr>
<tr>
<td>Group of pulses</td>
<td>15.75 ± 2.1 (12–18)</td>
<td>8.25 ± 0.6 (7–10)</td>
</tr>
<tr>
<td>Date and temperature</td>
<td>2 March 2015, 21.9 °C</td>
<td>26 March 2009, 24.3 °C</td>
</tr>
</tbody>
</table>
bands could be discerned. However, these structures only became evident in recordings made nearer the individuals. This was only possible in Serra da Jibóia and Santa Terezinha. At the other locations the individuals only called at the canopy and this interfered negatively in the quality of the recordings.

Finally, after roughly a decade of frustrated attempts and much speculation, during fieldwork at the Serra da Jiboia at the municipalities of Santa Teresinha and Elísio Medrado in Bahia, we found an insect emitting the same sound in a shrub just in front of a research station. The individual (Fig. 2) measured about seven centimeter, and belongs to Pterochrozinae, an exclusively Neotropical subfamily of Tettigoniidae (Orthoptera) in which are grouped leaf-like katydids. Pterochrozines are very diverse in the Brazilian Atlantic Forest and inhabit well preserved forest fragments, but unfortunately this group of katydids is understudied (JCH personal observations). The specimen was identified as Paracycloptera grandifolia (Brunner von Wattenwyl) based on a photo that was sent to the specialist in Tettigoniidae JCH. JCH had been collecting in Bahia in January of 2012 and also captured and photographed specimens of the same species. One specimen was housed at the Zoological Museum of Universidade Estadual de Santa Cruz (voucher CMSK-0001). At the same locality we registered a large abundance of these katydids and several other individuals were located in other shrubs. Males of this family attract females through sound they produce by rubbing specialized regions of the forewings (Montealegre-Z & Manson 2005). Most bioacoustics studies on species of Tettigoniidae revealed that they produce mainly ultra-sonic sounds (66%) and that the frequency used by the different species varies between 5 kHz and 150 kHz (Montealegre-Z 2009, Sarrias et al. 2014).

As acoustic transect sampling is a well-established amphibian monitoring protocol (Rödel & Ernst 2004) our findings may aid researchers undertaking amphibian inventories in Northeastern Brazil as we provide data that may aid herpetologists to identify this species of katydid during fieldwork. Furthermore we hope to stimulate specialists of katydid bioacoustics to continue studying this species which has revealed very different characteristics compared to those reported in the literature for the group. Maybe this species could reveal insights concerning the mechanisms and evolution of acoustic communication of those insects.

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References


