

Breeding activity of *Dendropsophus counani* (Anura: Hylidae) in eastern Brazilian Amazonia

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Recibida: 02 Febrero 2021

Revisada: 11 Agosto 2021

Aceptada: 19 Octubre 2021

Editor Asociado: C. Canedo

doi: 10.31017/CdH.2022.(2021-023)

ABSTRACT

The current knowledge on the natural history are still scarce for most species of Amazonian anurans. Among these, the hylid *Dendropsophus counani* has incipient data on its breeding biology. Herein, we studied the breeding biology of *D. counani* in the breeding seasons at Cancão Municipal Natural Park, municipality of Serra do Navio, Amapá state. Males of *D. counani* often start calling in the late afternoon (17:45 pm) and continue at night. All clutches had been deposited on tree leaves (n = 8) and branches (n = 9) above the water, and after a few days the eggs hatching into exotrophic tadpoles that dropped from the gelatinous clutch in lentic waters. The number of eggs per egg clutch ranged from 40 to 153 eggs. Our study adds necessary data about the natural history of this species, in addition to increasing the knowledge of the breeding biology of *Dendropsophus* species.

Key Words: Clutches; eggs; reproductive mode.

In the genus *Dendropsophus* Fitzinger, 1843, the reproductive mode with aquatic eggs and tadpoles is present in approximately 80% of the species (Touchon and Warkentin, 2008). Species with terrestrial eggs and others that exhibit reproductive plasticity (i.g., aquatic and terrestrial spawns) have also been registered for some species (Hartmann *et al.*, 2010; Mageski *et al.*, 2014; Silva *et al.*, 2019; Orrico *et al.*, 2021). However, the current knowledge on the natural history of anurans from the eastern Amazon are still scarce. As with many other species of *Dendropsophus* in Amazonia, there is little information on the natural history of *D. counani* Fouquet, Orrico, Ernst, Blanc, Martinez, Vacher, Rodrigues, Ouboter, Jairam & Ron, 2015. Indeed, some information has already been published on the vocalization, morphology of adults and juveniles, tadpoles and spawning for this species, however, its breeding activity remains

incipient (Fouquet *et al.*, 2015). Thus, the aim of this study was to provide data on breeding biology of *D. counani* from a primary forest in the state of Amapá, Eastern Amazon, Brazil.

Field observations were conducted in breeding sites in the temporary ponds in River Amapari trail (0°54'02.9"N, 52°00'48.2"W, 146 m a.s.l.) in the Cancão Municipal Natural Park, during two field trips to the study area in 2018 (19–21 January; 10–12 February). This Protected area is located about 2.5 km NW of the village of Pedra Preta, municipality of Serra do Navio, Amapá state, Brazil.

Forty-nine adult specimens were collected (37 males and 12 females), measured the snout-vent-length (SVL) using a digital caliper (0.5 mm precision, Mitutoyo) and weighed using a digital balance (0.1 g precision, Pesola). We counted the total number of males and females in the temporary pond

and recorded the variation in calling site height, amplexus, clutches and the reproductive mode. All specimens were deposited in the Herpetological Collection of Universidade Federal do Amapá, municipality of Macapá, Amapá, Brazil (Voucher specimens 1603–1652).

Eggs were obtained from clutches deposited by pairs, placed in plastic bags and preserved in 5% formalin after spawning. The diameter of 10 eggs per clutch was measured using the stereomicroscope, with a micrometric ocular (Hartmann *et al.*, 2010). Spearman correlation analyses were performed to test the relationship between size of female (snout-vent length SVL) and size of clutch (number of eggs counted in each female), and size of clutch and egg diameter. The operational sex ratio (OSR) was obtained by dividing the number of males by the number of females present at the breeding sites (Emlen and Oring, 1977). The Chi-squared was used to evaluate possible differences in sex ratio (Zar, 1999).

Males of *D. counani* often start calling in the late afternoon (ca. 17:45 pm) and continue at night. We recorded males of *D. counani* on tree branches and leaves after heavy rains at 0.60 and 1.70 m above the ground using overhanging vegetation as calling sites. We found 17 clutches of *D. counani* in natural environment. All clutches were deposited on tree leaves ($n = 8$) and branches ($n = 9$) above the water (Fig. 1), and after a few days the eggs hatching into exotrophic tadpoles that dropped from the gelatinous clutch in lentic waters (reproductive mode 24; *sensu* Haddad and Prado, 2005). We also observed other anuran species (e.g., *D. leucophyllatus* and *Phyllomedusa bicolor*) using leaves as perches to vocalize.

The number of eggs per egg clutch ranged from 40 to 153 eggs (91.1 ± 42.9 eggs, $n = 6$ clutches), and egg diameter ranged from 1.42–1.51 mm (1.47 ± 0.04 mm, $n = 60$ eggs from 6 clutches). We did not find significant correlations between female body size (SVL) and clutch size ($r_s = -0.3714$, $p = 0.47$), body mass and clutch size ($r_s = -0.6667$, $p = 0.15$), and body mass and egg diameter ($r_s = -0.1029$, $p = 0.85$) as well as egg diameter and SVL ($r_s = 0.1449$, $p = 0.49$) (Fig. 2). The operational sex ratio was 4.2:1 males/female (average = 3.2 ± 1.4) and a Chi-squared value greater than expected ($X^2 = 62.77$, $p = 0.07$).

The clutches of *D. counani* follow the same pattern found in other species of the genus. *Dendropsophus berthaltutzae* (Hartmann *et al.*, 2010), *D. ebraccatus* (Touchon and Warkentin, 2008), *D. haddadi* (Toledo *et al.*, 2012; Mageski *et al.*, 2014;

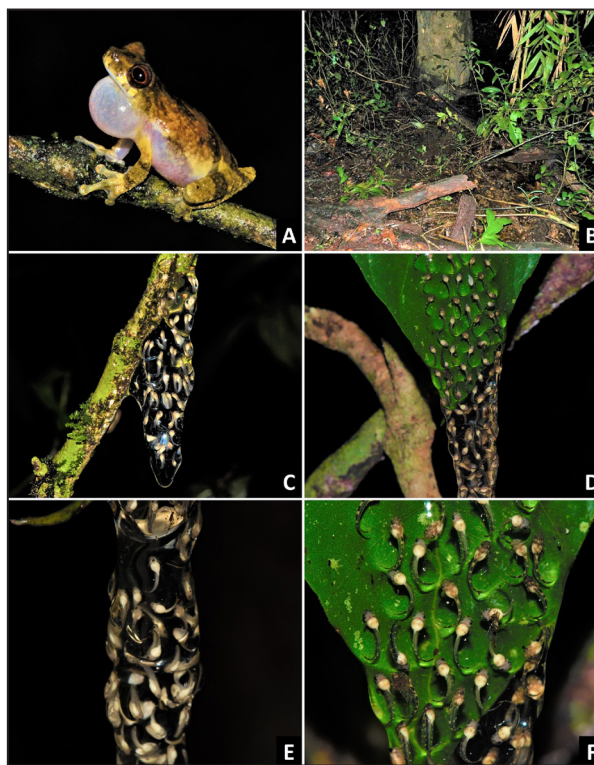


Figure 1. *Dendropsophus counani*: (A) calling male; (B) reproductive habitat located in municipality of Serra do Navio, Amapá state, Brazil, where frogs were sampled; (C), (D), (E) and (F) mature clutch on the leaves and tree branches hanging above water.

Silva *et al.*, 2019), *D. leucophyllatus* (Crump, 1974), and *D. microcephalus* (Duellmann, 1970) present the same reproductive mode (terrestrial eggs on leaves above lentic environments and exotrophic tadpoles that complete development in the water).

According to Fouquet *et al.* (2015), *Dendropsophus counani* is considered as an explosive breeding (*sensu* Wells, 1977). The males calling usually after heavy rains and male density at some choruses was high, resulting in some males calling a few centimeters away from each other. Amplexus is axillary and egg deposition occurred at the same tree branches and leaves where choruses were calling. Amplectant pairs and individuals moving actively out of their reproductive period were also observed during nighttime.

The number of eggs found in our study (153 eggs; 40–153) is higher than that found by Fouquet *et al.* (2015), (50–79 eggs). Clutch size in *D. counani* was not positively correlated with body size (SVL) and body mass of females. Crump (1974) found an inverse relationship between the reproductive investment and body size. This negative trend indi-

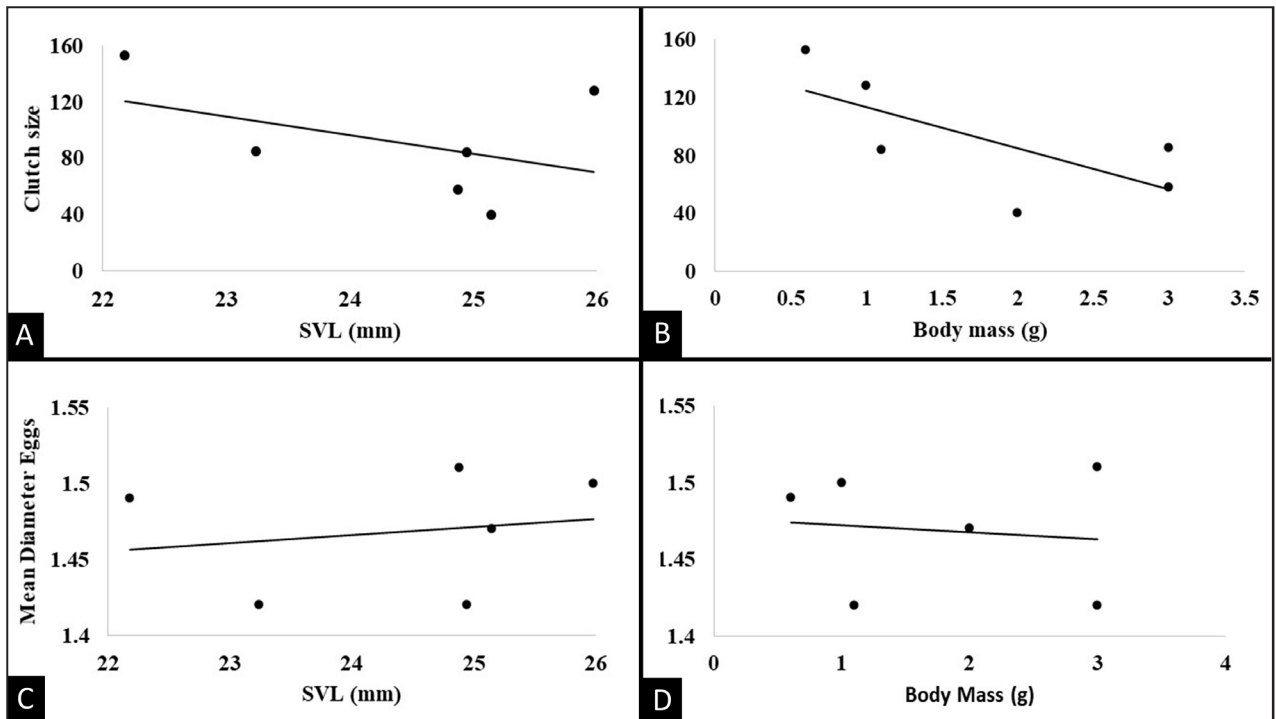


Figure 2. Relationship between (A) clutch size and SVL; (B) clutch size and body mass; (C) mean diameter eggs and SVL, and (D) mean diameter eggs and body mass in *Dendropsophus counani* females from a primary forest in eastern Amazon.

cates that as body size increases or less is invested in gonads. The females, although present in all samples, were often in fewer numbers. During the shorter reproduction period explosive breeding, the occurrence of reproductively active males is concentrated at a breeding site for only a few days. This could lead to relatively high daily proportions of males and a decline in operational sex ratio (A. Fouquet pers. comm.)

Information about species' ecology and behavior provides elements to take conservation and management decisions regarding an endangered or poorly known species (Sanabria *et al.*, 2005; Loyola *et al.*, 2008). In this way, our study adds necessary data on the natural history of a species that is still poorly known in the Amazon region. We expect that our data can improve knowledge about reproductive biology in *Dendropsophus* species.

Acknowledgments

This study was carried out as part of the Project "Natural history of anurans of eastern Amazon". We are thankful to Antoine Fouquet for identifying the *Dendropsophus counani*. We thank the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) for providing collection permits (SISBIO #48102-2) and Christoph Jaster (PARNA Montanhas

do Tumucumaque) for logistical support during the fieldwork.

Literature cited

- Crump, M.L. 1974. Reproductive strategies in a tropical anuran community. *Miscellaneous publication, University of Kansas publications, Museum of Natural History* 61: 1-68.
- Duellman, W.E. 1970. The Hylid frogs of Middle America. Society for the Study of Amphibians and Reptiles. New York. Ithaca.
- Emlen, S.T. & Oring, L.W. 1977. Ecology, Sexual Selection, and the Evolution of Mating Systems. *Science* 197: 215-223.
- Fouquet, A.; Orrico, V.D.D.; Ernst, R.; Blanc, M.; Martinez, Q.; Vacher, J.P.; Rodrigues, M.T.; Ouboter, P.; Jairam, R. & Ron, S. 2015. A new *Dendropsophus* Fitzinger, 1843 (Anura: Hylidae) of the parviceps group from the lowlands of the Guiana Shield. *Zootaxa* 4052: 39-64.
- Haddad, C.F.B. & Prado, C.P. 2005. Reproductive modes in frogs and their unexpected diversity in the Atlantic Forest of Brazil. *BioScience* 55: 207-217.
- Hartmann, M.T.; Hartmann, P.A. & Haddad, C.F.B. 2010. Reproductive modes and fecundity of an assemblage of anuran amphibians in the Atlantic rainforest, Brazil. *Iheringia Série Zoologia* 100: 207-215.
- Loyola, R.D.; Becker, C.G.; Kubota, U.; Haddad, C.F.B.; Fonseca, C.R. & Lewinsohn, T.M. 2008. Hung out to dry: choice of priority ecoregions for conserving threatened Neotropical anurans depends on life-history traits. *PlosOne* 3: e2120.
- Mageski, M.; Silva-Soares, T. & Ferreira, R.B. 2014. Hábito bromelígena de *Dendropsophus haddadi* (Anura: Hylidae) em ambiente de Mata Atlântica no sudeste do Brasil. *Boletim do Museu de Biologia Mello Leitão* 34: 97-100.

Sanches *et al.* — Breeding biology of *Dendropsophus counani*

- Orrico, V.G.D.; Grant, T.; Faivovich, J.; Rivere-Correa, M.; Rada, M.A.; Lyra, M.L.; Cassini, C.S.; Valdujo, P.H.; Schargel, W.E.; Machado, D.J.; Wheeler, W.C.; Barrio-Amorós, C.; Loebmann, D.; Moravec, J.; Zina, J.; Solé, M.; Sturaro, M.J.; Peloso, P.L.V.; Suarez, P. & Haddad, C.F.B. 2021. The phylogeny of Dendropsophini (Anura: Hylidae: Hylinae). *Cladistics* 37: 73-105.
- Sanabria, E.A.; Quiroga, L.B. & Acosta, J.C. 2005. Dieta de *Leptodactylus ocellatus* (Linnaeus, 1758) (Anura: Leptodactylidae) en un humedal del oeste de Argentina. *Revista Peruana de Biología* 12: 473-477.
- Silva, N.R.; Neto, J.A.; Prado, C.P.A. & Mott, T. 2019. Reproductive biology of *Dendropsophus haddadi* (Bastos and Pombal, 1994), a small treefrog of the Atlantic forest. *Herpetology Notes* 12: 319-325.
- Toledo, L.F.; Garey, M.V.; Costa, T.R.; Lourenço-de-Moraes, R.; Hartmann, M.T. & Haddad, C.F.B. 2012. Alternative reproductive modes of Atlantic forest frogs. *Journal of Ethology* 30: 331-336.
- Touchon, J.C. & Warkentin, K.M. 2008. Reproductive mode plasticity: aquatic and terrestrial oviposition in a treefrog. *Proceedings of the Natural Academy of Sciences* 105: 7495-7499.
- Wells, K.D. 1977. The social behaviour of anuran amphibians. *Animal Behaviour* 25: 666-693.
- Zar, J.H. 1999. *Biostatistical Analysis*. Prentice Hall, Upper Saddle River.

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