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Notes on courtship, egg-laying site, and defensive behavior of *Epipedobates flavopictus* (Anura, Dendrobatidae) from two mountain ranges of central and southeastern Brazil

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Epipedobates flavopictus (Lutz, 1925) is a member of the *E. pictus* species group (Silverstone 1976) that can be found in the Brazilian states of Minas Gerais, Goiás, Tocantins, Pará, and Maranhão (Frost 2004). This species has been under taxonomic discussion recently (Haddad and Martins 1994) but little information is available on its reproductive biology. Haddad and Martins (1994) have described its advertisement call, morphology of tadpoles and adults. It was also reported that males call from rock crevices at creek margins in rock fields, a common formation of central Brazil (Haddad and Martins 1994). There is also an indication that this species could perform deimatic behavior, similarly to *Pleurodema brachyops*, but no descriptions were provided (see Martins 1989, where *E. flavopictus* is treated in the genus *Dendrobates*). Herein, we describe the oviposition site, the egg-masses, the courtship call, and the deimatic behavior associated to parental care exhibited by one individual of *E. flavopictus*.

Field observations were made on 8 November 1989, at Municipality of Santana do Riacho, Serra do Cipó, state of Minas Gerais, southeastern Brazil (19º25' S, 43º32' W, about 800 m above sea level), and on 17 and 18 December 2003 at the Vale da Lua, Municipality of Alto Paraíso, Chapada dos Veadeiros, state of Goiás, central Brazil (14º11' S, 47º47' W, about 905 m above sea level). Adult specimens, tadpoles, and eggs were collected and measured with a digital caliper to the nearest 0.01 mm. The specimens were deposited at Célio F. B. Haddad anuran collection (CFBH), Departamento de Zoologia, Universidade Estadual Paulista, Rio Claro, State of São Paulo, Brazil. Tadpoles were staged according to Gosner (1960) and measured according to Altig (1970). Vocalizations were recorded with a Marantz PMD222 tape recorder and a Sennheiser MT80 microphone.

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Figure 1 - Egg-mass of *Epipedobates flavopictus* collected at Vale da Lua, municipality of Alto Paraíso, State of Goiás, central Brazil.

Figure 2 - Adult male *Epipedobates flavopictus* with tadpoles on dorsum (indicated by an arrow) and exhibiting the reddish femoral stripes of its legs after being disturbed. Individual observed at Santana do Riacho, Serra do Cipó, State of Minas Gerais, southeastern Brazil.

On 18 December 2003 an adult male was observed emitting advertisement calls (169 calls per minute) from a rock crevice during the day. The calls consisted of four to six pulses, of modulated notes with increasing frequency. Mean note duration lasted 92 ± 81 ms (range 71–98, N = 19), and mean inter-note interval was 308 ± 94 ms (237–486, N = 19). The mean dominant frequency was 3.8 ± 0.02 KHz (3.7–3.8, N = 19). These calls were similar to those previously described from other localities (Haddad *et al.* 1988, Haddad and Martins 1994). On 17 December 2003 an adult male (SVL 28.35 mm, CFBH 6672) was observed during daylight emitting courtship calls, which were similar to the advertisement calls, but with a lower intensity of energy (not recorded), at 5 to 10 cm from a female. They were under a pile of rocks, approximately 10 m from the nearest creek. The female remained quiet for over 10 minutes when the animals were disturbed by the observers.

When removing the rocks to capture the individuals, two egg-masses were found on the ground (Figure 1), approximately 10 cm from where the pair was found. The egg-masses were in different stages of development, suggesting that they were not laid on the same day. One of the egg-masses contained 31 eggs measuring 4.78 ± 0.31 mm (4.19–5.21, N = 10) in diameter (considering the gelatinous capsules). The other clutch had 24 eggs. One of the egg-masses lasted one week until the simultaneous hatching of the tadpoles. Just before hatching, the eggs had a mean diameter of 6.64 ± 0.77 mm (5.54–7.57, N = 6). After emerging, the tadpoles were between the stages 21 and 24 and measured 4.04 ± 0.08 mm (3.96–4.2, N = 9) in body length, and 7.22 ± 0.52 mm (6.38–7.82, N = 9) in tail length.

An adult male with 18 tadpoles on his dorsum was found at Serra do Cipó. This number of tadpoles could represent an entire clutch as the tadpoles of one clutch hatch at the same time. Upon handling disturbance for taking pictures, the male raised his body and stretched his legs backwards exhibiting the bright and reddish femoral stripes (Figure 2), a behavior that can be interpreted as deimatic, functioning as defense against visually oriented predators (Martins 1989). Furthermore, out of 11 males handled, only the single one with tadpoles on the

dorsum exhibited this deimatic behavior, hence it could be related to parental care. Defensive behaviors closely related with parental care had been previously reported for some species in two leptodactylid genus (Vaz-Ferreira and Gehrau 1975, Giaretta and Cardoso 1995, Vaira 1997, Martins 2001).

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