

Multiple and heterospecific amplexi between the toads *Rhaebo guttatus* and *Rhinella marina* (Anura: Bufonidae)

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Male anurans exhibit four alternative behavioral strategies to form an amplexi (Pombal-Júnior and Haddad, 2007): (1) active search for females, (2) displacing other males in amplexi, (3) satellite male behavior and (4) polyandry. The active search for females and the behavior of displacing other males in already-formed amplexi occur mainly when the number of females is smaller than the number of males during reproduction (Davies and Halliday, 1977; Wogel, Abrunhosa and Pombal-Júnior, 2005; Pombal-Júnior and Haddad, 2007). According to Wells (1977), differences in anuran advertisement calls is one mechanism to reduce heterospecific matings (see Haddad, Pombal-Júnior and Batistic, 1994; Haddad, Cardoso and Castanho, 1990). Cases of hybridization were recorded in many bufonids both in tropical genera such as *Anaxyrus* and *Rhinella* (Feder, 1979; Sullivan, 1986; Haddad, Cardoso and Castanho, 1990) but also in temperate species (e.g. McCoy, Smith and Tihen 1967, Hemmer 1973). In those genera, in which explosive reproduction is frequent, errors in the formation of couples may occur due to the strategies 'active search' and 'displacement of males', and also because of the low selectivity of females (Haddad, Cardoso and Castanho, 1990).

Here we present records of heterospecific couples and of multiple amplexi between *Rhaebo guttatus* and *Rhinella marina*, two common toad species found in sympatry in many localities across the Amazon (Duellman, 1990; Caldwell and Araújo, 2005; Bernarde, 2007).

The records were made in Parque Nacional do Jurueña (PNJ), northern Mato Grosso state and southeastern

Amazonas state, which extends nearly up to two million hectares. PNJ is located within the Brazilian Central Amazon, characterized by a high diversity of vegetation mosaics and soils, and where there are transitional areas between semi-deciduous seasonal forest and dense rainforest, as well as between those vegetations and Cerrado (RADAMBRASIL, 1980). On the nights of March 6th, 7th and 9th 2008, we observed individuals of *Rhaebo guttatus* and *Rhinella marina* in reproductive activity. We recorded and photographed their behavior. Males of those species were vocalizing and also actively searching for females on the margins of the rivers Teles Pires (7°31'S, 57°58'W) and Tapajós (7°5'S, 58°14'W).

On the night of March 6th, around 19:30, we found a male of *Rhinella marina* in amplexi with a female of *Rhaebo guttatus*, while another male of *Rhaebo guttatus* was trying to displace the first male, even while it was itself in amplexi with another conspecific male (Figure 1a). On the following night, March 7th, around 21:40, we recorded three male of *Rhinella marina* and one male of *Rhaebo guttatus* in amplexi with a female of *Rhinella marina* (Figure 1b). On the same night, at 21:44, we also observed a male of *Rhaebo guttatus* in amplexi with a female of *Rhinella marina* (Figure 1c). On March 9th, around 18:30, a male of *Rhinella marina* was recorded in amplexi with a male of *Rhaebo guttatus* (Figure 1d).

During the explosive reproduction of *Rhaebo guttatus* and *Rhinella marina*, the reproductive strategy 'active search' is more frequent, and increases the chance of heterospecific couples and multiple amplexi (Pombal-Júnior and Haddad, 2007). At that time *Rhinella* male toads are little selective, getting closer and forming amplexi with anything that moves nearby (see Haddad, Cardoso and Castanho, 1990; Haddad and Sazima, 1992). *Rhaebo guttatus* and *Rhinella marina* are easily identified via their mating calls (PSB and RAM, personal observation), as it was registered in the Atlantic Forest for *Rhinella ornata* and *R. icterica*

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Figure 1. Heterospecific couples and multiple amplexi between *Rhaebo guttatus* and *Rhinella marina*: (A) a male of *R. marina* and two males of *R. guttatus* in amplexi with a female of *R. guttatus* (photo by RAM); (B) three males of *R. marina* and a male of *R. guttatus* in amplexi with a female of *R. marina* (photo by PSB); (C) a male of *R. guttatus* in amplexi with a female of *R. marina* (photo by PSB); (D) a male of *R. marina* in amplexi with a male of *R. guttatus* (photo by RAM).

(Haddad, Cardoso and Castanho, 1990; Haddad and Sazima, 1992). However, as for the two species of *Rhinella* from the Atlantic Forest (see Haddad, Cardoso and Castanho 1990), this difference was not enough to prevent amplexi between heterospecific toads *R. marina* and *R. guttatus*. Despite the many ways that multiple amplexi influence sexual selection of organisms with external fertilisation such as anurans (Vicites et al., 2004), heterospecific matings may result in unviable hybrids. Energetically this would be a waste in terms of gametes and results in reproductive failure of the individuals involved (Haddad, Cardoso and Castanho, 1990). Sympatry, syntopy and explosive reproduction also favor heterospecific matings (Haddad, Cardoso and Castanho, 1990). Bernarde (2007), in Espigão do Oeste, state of Rondônia, Brazil, recorded these two species in synchronopatry, though heterospecific couples were not observed (PSB, personal observation).

When many males try to form an amplexi with a female, there are many strategies to exclude competing

males (Lamb, 1984), but the displacer male takes the risk of killing the female (Trauth, Mccallum and Cartwright, 2000; RAM, personal observation). Amplexi formed with large males may constrain locomotion and feeding of females, and this constraint increases when multiple males are involved in the amplexi (Bowcock, Brown and Shine, 2009).

Acknowledgments. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) granted the license for scientific activities (License: 12171-1, Record in IBAMA: 1909428). Instituto Centro de Vida (ICV) and Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) provided us with logistic support, both in the municipality of Alta Floresta, state of Mato Grosso, Brazil. CNPq provided fellowships to R. A. Machado (502736/2009-7), and P. S. Bernarde (501927/2009-3).

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