

SHORT COMMUNICATION

Adults and tadpoles of species of Hylodidae (Anura): History and taxonomy perspectives

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ABSTRACT. We make a historical review of the rates of descriptions of adult and larval forms of frogs of the three genera of Hylodidae: *Crossodactylus* Duméril & Bibron, 1841; *Hylodes* Fitzinger, 1826; and *Megaelasia* Miranda-Ribeiro, 1923. We analyze and compare the evolution of the number of descriptions of adults and tadpoles of the 42 species presently known in the family. There has been an increase in the number of descriptions of both adult and larval forms in the last decades. Nevertheless, the number of descriptions of tadpoles still does not match the number of adult forms described in Hylodidae. The great number of Hylodidae recent described and the continuous process of deforestation in Atlantic forest remnants emphasize the need to improve research efforts for this group.

KEY WORDS. Anuran description; Atlantic Forest; *Crossodactylus*; *Hylodes*; *Megaelasia*.

Hylodidae is currently composed of three anuran genera: *Crossodactylus* Duméril & Bibron, 1841; *Hylodes* Fitzinger, 1826; and *Megaelasia* Miranda-Ribeiro, 1923 (FROST 2011). The species of this family, also known as torrent frogs, are rheophilic and are mainly associated with the Brazilian Atlantic Forest (POMBAL *et al.* 2003, LINGNAU *et al.* 2008, PIMENTA *et al.* 2008, SILVA & BENMAMAN 2008, VERDADE & RODRIGUES 2008). The species of Hylodidae are distributed from northeastern to southern Brazil and northern Argentina (GALLARDO 1961, CARCERELLI & CARAMASCHI 1993, FROST 2011). In this study, we conducted an extensive systematic search for publications in taxonomy describing adults and tadpoles of Hylodidae using two online tools “Amphibian Species of the World: An Online Reference” (FROST 2011) and “ISI Web of Knowledge”. We looked for the following data in those sources: I) description of the adult form only, II) description of larval form only, or III) description of both forms.

Currently, Hylodidae has 42 described species (Tab. I). Tadpoles have been described only for 25 of them (59.5%) Out of the 11 species currently known in *Crossodactylus*, only six (54.5%) have had their larvae described. A similar trend applies to the 24 species in *Hylodes*: tadpoles have been described for 14 species only (58.3%). Out of the seven species in *Megaelasia*, five (or 71.4%) of larval forms are formally known.

The first description of an adult form of a Hylodidae occurred in 1823, for *H. nasus* (Lichtenstein, 1823). In the following 157 years, 17 more adult forms of Hylodidae were described (Fig. 1). The remaining 24 species were described only within the last 30 years, between 1981 and 2011. The first de-

scriptions of a larval form of a Hylodidae species occurred more than a century after the first description of the adult form, in 1930 (Lutz, 1930) [*H. nasus*, *H. lateristrigatus* and *M. goeldii* (Baumann, 1912)]. By the end of the 1970s, in a period of about forty years, only tadpoles of two additional species were described. From 1981 to 2011, 20 larval forms of Hylodidae species were described.

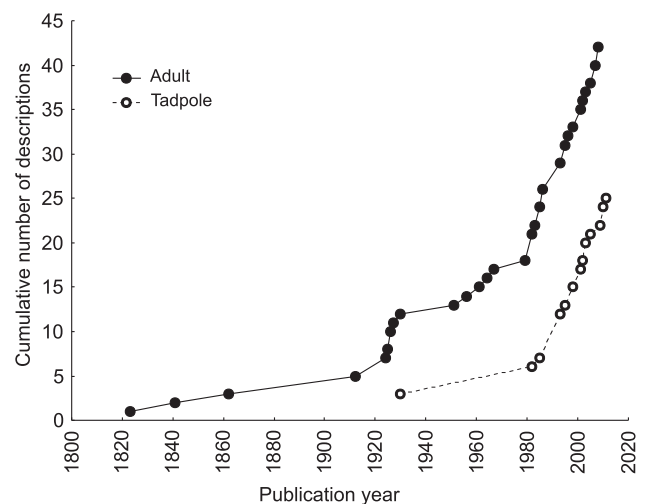


Figure 1. Cumulative number of descriptions of Hylodidae species through time. (●) Adult forms, (○) larval forms.

Table I. Species of Hylodidae (*Crossodactylus*, *Hylodes*, and *Megaelasia*), and descriptions dates of their adults and tadpoles.

Species	Adult described by	Tadpole described by
<i>C. aeneus</i>	MÜLLER (1924)	–
<i>C. bokermanni</i>	CARAMASCHI & SAZIMA (1985)	CARAMASCHI & SAZIMA (1985)
<i>C. caramaschii</i>	BASTOS & POMBAL (1995)	–
<i>C. cyclopinus</i>	NASCIMENTO <i>et al.</i> (2005)	NASCIMENTO <i>et al.</i> (2005)
<i>C. dantei</i>	CARCERELLI & CARAMASCHI (1993)	–
<i>C. dispar</i>	LUTZ (1925)	BOKERMANN (1963)
<i>C. gaudichaudii</i>	DUMÉRIL & BIBRON (1841)	FRANCIONI & CARCERELLI (1993)
<i>C. grandis</i>	LUTZ (1951)	–
<i>C. lutzorum</i>	CARCERELLI & CARAMASCHI (1993)	–
<i>C. schmidti</i>	GALLARDO (1961)	FAIVOVICH (1998)
<i>C. trachystomus</i>	REINHARDT & LÜTKEN (1862)	CARAMASCHI & KISTEUMACHER (1989)
<i>H. amnicola</i>	POMBAL <i>et al.</i> (2002)	POMBAL <i>et al.</i> (2002)
<i>H. asper</i>	MÜLLER (1924)	BOKERMANN (1963), COSTA <i>et al.</i> (2010a)
<i>H. babax</i>	HEYER (1982)	PIRANI <i>et al.</i> (2011)
<i>H. cardosoi</i>	LINGNAU <i>et al.</i> (2008)	–
<i>H. charadranaetes</i>	HEYER & COCROFT (1986)	COSTA <i>et al.</i> (2010b)
<i>H. dactylocinus</i>	PAVAN <i>et al.</i> (2001)	PAVAN <i>et al.</i> (2001)
<i>H. fredii</i>	CANEDO & POMBAL (2007)	LAIA <i>et al.</i> (2010)
<i>H. glaber</i>	MIRANDA-RIBEIRO (1926)	–
<i>H. heyeri</i>	HADDAD <i>et al.</i> (1996)	COSTA <i>et al.</i> (2009)
<i>H. lateristrigatus</i>	BAUMANN (1912)	LUTZ (1930)
<i>H. magalhaesi</i>	BOKERMANN (1964)	–
<i>H. meridionalis</i>	MERTENS (1927)	–
<i>H. mertensi</i>	BOKERMANN (1956)	–
<i>H. nasus</i>	LICHTENSTEIN (1823)	LUTZ (1930), WOGEL <i>et al.</i> (2004)
<i>H. ornatus</i>	BOKERMANN (1967)	–
<i>H. otavioi</i>	SAZIMA & BOKERMANN (1982)	SAZIMA & BOKERMANN (1982)
<i>H. perere</i>	SILVA & BENMAMAN (2008)	–
<i>H. perplicatus</i>	MIRANDA-RIBEIRO (1926), HADDAD <i>et al.</i> (2003)	HADDAD <i>et al.</i> (2003)
<i>H. phyllodes</i>	HEYER & COCROFT (1986)	HEYER <i>et al.</i> (1990)
<i>H. pipilans</i>	CANEDO & POMBAL (2007)	–
<i>H. regius</i>	GOUVÊA (1979)	–
<i>H. sazimai</i>	HADDAD & POMBAL (1995)	HADDAD & POMBAL (1995)
<i>H. uai</i>	NASCIMENTO <i>et al.</i> (2001)	NASCIMENTO <i>et al.</i> (2001)
<i>H. vanzolinii</i>	HEYER (1982)	–
<i>M. apuana</i>	POMBAL <i>et al.</i> (2003)	POMBAL <i>et al.</i> (2003)
<i>M. bocainensis</i>	GIARETTA <i>et al.</i> (1993)	–
<i>M. boticariana</i>	GIARETTA & AGUIAR (1998)	GIARETTA & AGUIAR (1998)
<i>M. goeldii</i>	BAUMANN (1912)	LUTZ (1930)
<i>M. jordanensis</i>	HEYER (1983)	–
<i>M. lutzae</i>	IZECKSOHN & GOUVÊA (1985)	GIARETTA <i>et al.</i> (1993)
<i>M. massarti</i>	DE WITTE (1930)	GIARETTA <i>et al.</i> (1993)

In 1982, the description of *Hylodes otavioi* Sazima & Bokermann was the first taxonomic contribution that included the described both larval and adult forms. Unfortunately, descriptions of species of Hylodidae that include the formal description of both the adult and the larval form are quite rare when compared with studies describing the larval form of a species already described (nine and 16 respectively).

We identified a marked increase in the rate of descriptions of both adult and larval forms after the 1980s, a trend that continues nowadays and which follows the identification and description of new species of Hylodidae (Fig. 1). The time lag between the descriptions of adult forms and their respective larval forms was about 60 years in 1960, steadily decreasing to 40 years in 2000, and to 20 years in 2010, suggesting that the description of larval forms has been intensified for the species in this group. However, the number of descriptions of tadpoles still do not match the number of adult forms of Hylodidae known to science. This difference has remained stable in recent years, because adult forms of new species continue to be described in similar proportion to larval forms. In the last decade adult forms of seven species of *Hylodes* (*H. amnicola* Pombal, Feio & Haddad, 2002; *H. cardosoi* Lingnau, Canedo & Pombal, 2008; *H. dactylocinus* Pavan, Narvaes &

Rodrigues, 2001; *H. fredei* Canedo & Pombal, 2007; *H. perere* Silva & Benmaman, 2008; *H. pipilans* Canedo & Pombal, 2007; *H. uai* Nascimento, Pombal & Haddad, 2001), tadpoles of eight species [*H. amnicola*; *H. babax* Heyer, 1982; *H. charadranaetes* Heyer & Cocroft, 1986; *H. dactylocinus*; *H. fredei*; *H. heyeri* Haddad, Pombal & Bastos 1996; *H. perplicatus* (Miranda-Ribeiro, 1926); *H. uai*], an adult and tadpole of *Crossodactylus* (*C. cyclospinus* Nascimento, Cruz & Feio, 2005), and an adult and tadpole of *Megaelasia* (*M. apuana* Pombal, Prado & Canedo, 2003) have been described.

The extensive rate of deforestation of the Atlantic Forest probably has directly affected Hylodidae species, since the species found in this biome are mostly restricted to forest environments. The type-locality of only three species of Hylodidae [*C. bokermanni* Caramaschi & Sazima, 1985; *C. trachystomus* (Reinhardt & Luetken, 1862); and *H. otavioi*], represented by a total of 42, is outside of the Atlantic Forest biome (Fig. 2), as follows: *C. bokermanni* and *H. otavioi* were described from Serra do Cipó, state of Minas Gerais, and *C. trachystomus* from the municipality of Lagoa Santa, also in Minas Gerais. Both localities are within the Cerrado biome, even though are located very close to the ecotone with the Atlantic Forest. The type-locality of *Hylodes uai* is in the municipality of Belo Horizonte,



Figure 2. Type-localities of Hylodidae species (source: FROST 2011). The Brazilian Atlantic Forest biome is highlighted in gray. Source: MMA (2011).

Minas Gerais, an Atlantic Forest-Cerrado ecotone. The type-locality of *C. schmidtii* Gallardo, 1961 is within the Atlantic Forest of Misiones province, Argentina. Considering that the actual remaining Atlantic Forest is from 11.4% to 16.0% (RIBEIRO *et al.* 2009) the size of its original range, we hypothesize that several Hylodidae species might be presently at serious risk of extinction, considering the continuous process of deforestation in Atlantic forest remnants.

We ascertained the conservation status of 39 out of the 42 known species of Hylodidae using the IUCN Red List of Threatened Species (IUCN 2010). According to that list, *Hylodes cardosoi*, *H. perere* and *M. jordanensis* (Heyer, 1983) have not been evaluated. Twenty-eight out of the 39 species (71.8%) are categorized as Data Deficient (DD). The knowledge we presently have on populations and species distributions of Hylodidae is still scarce. Increased efforts in search for new populations of these frogs, and gathering more data about them (VERDADE & RODRIGUES 2008), will probably result in discoveries of new species (as shown at the ascending pattern in Figure 1).

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