PREDATION ON FOAM NESTS OF TWO LEPTODACTYLID FROGS BY sp. (HYMENOPTERA, FORMICIDAE) AND (SERPENTES, COLUBRIDAE)

Foam nests occur in at least six anuran families: Hylidae, Hyperoliidae, Leptodactylidae, Microhylidae, Myobatrachidae, and Rhacophoridae (ANDREONE et al., 2005; HADDAD et al., 1990; HADDAD and PRADO, 2005). There are various hypotheses that try to explain the function of foam nests, such as inhibition of tadpole growth (PISANO and DEL RIO, 1968; but see DOWNIE, 1994), protection against desiccation (RYAN, 1985; DOWNIE, 1988), food source (TANAKA and NISHIHIRA, 1987), temperature control (DOWNIE, 1988), defense against predators (DOWNIE, 1988, 1990), improvement of oxygen supply (SEYMOUR and LOVERIDGE, 1994), and acceleration of growth rate (PRADO et al., 2005). Regarding the hypothesis of defense against predators, in this paper we report two predation events on anuran foam nests. All observations were made in the farm Serra da Esperança, Municipality of Lebon Régis, Santa Catarina state, Brazil. The farm is situated in the mid-west plateau of Santa Catarina, an area originally covered by the Floresta Ombrófila Mista, characterized mainly by the presence of the Brazilian Pine, *Araucaria angustifolia*. Most of the area (488 ha) was partially altered by human activity, consisting now of a primary forest from which *A. angustifolia* was suppressed, in secondary forest (capoeirão), and open areas. In the surroundings, some patches of introduced *Pinus elliottii* also occur.

The first observation was made on 21 August 2005, when ants (*Solenopsis* sp.) were seen eating the eggs on the outermost layer of a foam nest of *Physalaemus* aff. *gracilis* (Fig. 1). The foam was located at the margins of a small road, inside an artificial channel. SAZIMA (1972) also observed ants of the genus *Solenopsis* carrying eggs and foam from a nest of *Physalaemus cuvieri* to their nests. RYAN (1985) observed tadpoles of *Agalychnis callidryas* eating eggs of *Physalaemus pustulosus* from the submerged parts of the foam nest. The same author also suggested that communal nesting could increase the protection against predation and desiccation, due to nest surface-to-volume ratio. For a given volume, the smaller the surface exposed to the environment, the smaller the number of eggs exposed to predation and desiccation (RYAN, 1985). MARTINS (2001) observed females of *Leptodactylus podicipinus* capturing ants on the nest they were attending, but the author did not mention any predation attempt by the ants. PRADO et al. (2005) reported ant predation (*Camponotus rufipes*) on eggs in a foam nest of *Leptodactylus labyrinthicus*. Predation on eggs of various vertebrates by ants of the genus *Solenopsis* seems to be common, since there are at least reports on predation of eggs of lizards and snakes (CONNERS, 1998; CHALCRAFT and ANDREWS, 1999). However, neither lizards nor snakes produce foam nests that could protect the eggs.

Our second observation was on 24 October 2005. One foam nest of *Leptodactylus ocellatus* was found at night in a pond of ca. 2 ha, at 60 cm depth. In its center, there was an adult *Liophis miliaris*, attempting to eat the eggs. One of us (RL) tried to capture the snake, but it escaped and returned about two minutes later, when it was photographed. Previous reports of snakes feeding on anuran eggs from foam nests include *Liophis jaegeri* (feeding on eggs of *Leptodactylus plaumanni*, SOLÉ and KWET, 2003) and an unknown colubrid snake (attempting to feed on eggs of *Leptodactylus labyrinthicus*, PRADO et al., 2005).

Leptodactylids exhibit an evolutionary trend in reproduction to become gradually independent of water (HEYER, 1969; PRADO et al., 2002). In more terrestrial environments they may escape from voracious predators present in permanent water bodies (HEYER et al., 1975), but in contrast they will confront the risks offered by terrestrial predators, such as numerous ants (SAZIMA 1972, PRADO et al. 2005; this study).

Although the records of predation on foam nests have been increasing recently, we do not believe that the foam is ineffective in protecting the eggs (see also BOKERMANN, 1957; VILLA et al., 1982; RÖDEL et al., 2002; MENIN and GIARETTA, 2003). The gluing nature of the foam itself seems to be one obstacle to some kinds of terrestrial animals, as ants appear to eat only the eggs of the outermost layer of the nest. Vertebrates like snakes, however, probably can eat the entire foam nest or, at least, eggs from any part of the nest.

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REFERENCES

ANDREONE, F.; VENCES, M.; VIEITES, D. R.; GLAW, F.; MEYER, A. Recurrent ecological adaptions revealed through a molecular analysis of the secretive cophyline frogs of Madagascar. **Molecular Phylogenetics and Evolution**, Michigan, v. 34, p. 315-322, 2005.

BOKERMANN, W. C. A. Frog eggs parasitized by dipterous larvae. **Herpetologica**, Bainbridge, v. 13, p. 231-232, 1957.

CHALCRAFT, D. R.; ANDREWS, R. M. Predation on lizard eggs by ants: species interactions in a variable physical environment. **Oecologia**, Berlin, v. 119, p. 285-292, 1999.

CONNERS, J. S. *Opheodrys aestivus* (Rough green snake). Egg predation. **Herpetological Review**, Saint Louis, v. 29, p. 243. 1998.

DOWNIE, J. R. Functions of the foam in the foam-nesting leptodactylid *Physalaemus pustulosus*. **Herpetological Journal**, London, v. 1, p. 302-307, 1988.

DOWNIE, J. R. Functions of the foam in foam-nesting leptodactylids: anti-predator effects of *Physalaemus pustulosus* foam. **Herpetological Journal**, London, v. 1, p. 501-503, 1990.

DOWNIE, J. R. Developmental arrest in *Leptodactylus fuscus* tadpoles (Anura: Leptodactylidae). II: Does a foam-borne factor block development? **Herpetological Journal**, London, v. 4, p. 39-45, 1994.

HADDAD, C. F. B.; POMBAL Jr., J. P.; GORDO, M. Foam nesting in a hylid frog (Amphibia, Anura). **Journal of Herpetology**, New Haven, v. 24, p. 225-226, 1990.

HADDAD, C. F. B.; PRADO, C. P. A. Reproductive modes in frogs and their unexpected diversity in the Atlantic Forest of Brazil. **Bioscience**, Washington, v. 55, n. 3, p. 207-217, 2005.

HEYER, W. R. The adaptive ecology of the species groups of the genus *Leptodactylus* (Amphibia, Leptodactylidae). **Evolution**, Tempe, v. 23, p. 421-428, 1969.

HEYER, W. R.; McDIARMID, R. W.; WEIGMANN, D. L. Tadpoles, predation and pond habitats in the tropics. **Biotropica**, Storrs, v. 7, n. 2, p. 100-111, 1975.

MARTINS, I. A. Parental care behaviour in *Leptodactylus podicipinus* (Cope, 1862) (Anura, Leptodactylidae). **Herpetological Journal**, London, v. 11, p. 29-32, 2001.

MENIN, M.; GIARETTA, A. A. Predation on foam nests of leptodactyline frogs (Anura: Leptodactylidae) by larvae of *Beckeriella niger* (Diptera: Ephydridae). **Journal of Zoology**, London, v. 261, p. 239-243, 2003.

PISANO, A.; DEL RIO, A. G. New biological properties in the foamy jelly of Amphibians. **Archivio Zoologico Italiano**, Torino, v. 53, p. 189-202, 1968.

PRADO, C. P. A.; UETANABARO, M.; HADDAD, C. F. B. Description of a new reproductive mode in *Leptodactylus* (Anura, Leptodactylidae), with a review of the reproductive specialization toward terrestriality in the genus. **Copeia**, Lawrence, v. 2002, n. 4, p. 1128-1133, 2002.

PRADO, C. P. A.; TOLEDO, L. F.; ZINA, J.; HADDAD, C. F. B. Trophic eggs in the foam nests of *Leptodactylus labyrinthicus* (Anura, Leptodactylidae): an experimental approach. **Herpetological Journal**, London, v. 15, p. 279-284, 2005.

RÖDEL, M.-O.; RANGE, R.; SEPPÄNEN, J.-T.; NOË, R. Caviar in the rain forest: monkeys as frog-spawn predators in Taï National Park, Ivory Coast. **Journal of Tropical Ecology**, Cambridge, v. 18, p. 289-294, 2002.

RYAN, M. J. **The túngara frog. A study in sexual selection and communication**. Chicago and London: The University of Chicago Press. 1985. 230p.

SAZIMA, I. Predadores do anuro *Physalaemus curievi* na Cidade Universitária "Armando de Salles Oliveira" São Paulo. **Ciência e Cultura (Suplemento)**, v. 24, n. 6, 1972.

SEYMOUR, R. S.; LOVERIDGE, J. P. Embryonic and larval respiration in the arboreal foam nests of the african frog *Chiromantis xerampelina*. **Journal of Experimental Biology**, Cambridge, v. 197, p. 31-46, 1994.

SOLÉ, M.; KWET, A. *Liophis jaegeri*. Diet. **Herpetological Review**, Saint Louis, v. 34, n. 1, p. 69, 2003.

TANAKA, S.; NISHIHIRA, M. Foam nest as a potential food source for anuran larvae: a preliminary experiment. **Journal of Ethology**, Tokyo, v. 5, p. 86-88, 1987.

VILLA, J.; McDIARMID, R. W.; GALLARDO, J. M. Arthropod predators of leptodactylid frog foam nests. **Brenesia**, San Jose, v. 19/20, p. 577-589, 1982.

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Fig. 1. Ants of the genus *Solenopsis* predating eggs on the foam nest of *Physalaemus* aff. *gracilis*.

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