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# Report of agonistic interaction in Malagasy frogs of the genus *Gephyromantis* (Anura, Mantellidae)

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## Abstract

*Report of agonistic interaction in Malagasy frogs of the genus Gephyromantis (Anura, Mantellidae).* Territorial behaviour has been recorded in several amphibian families but rarely in frogs from Madagascar, despite the extremely high species diversity in the country. Here we describe the agonistic encounter of two male frogs of the Malagasy–endemic genus *Gephyromantis*. The physical combat was preceded by a switch from the advertisement call to a more aggressive tone of the resident male upon the intruder approaching. Although no physical interaction has been reported before, the change in call type is similar to that observed in other *Gephyromantis*. The combat lasted for about one minute with both males trying to subdue each other, until the intruder retreated.

Key words: Agonistic behaviour, Aggressive call, *Gephyromantis*, Madagascar, Mantellid

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## Resumen

*Informe sobre interacción agonística en ranas de Malasia del género Gephyromantis (Anura, Mantellidae).* Existen informaciones sobre el comportamiento territorial de varias familias de anfibios, pero son muy escasas las referentes a ranas de Madagascar, a pesar de la diversidad extremadamente alta de especies existente en el país. Aquí se describe el encuentro agonístico de dos machos del género *Gephyromantis*, endémico de Madagascar. El combate físico fue precedido de un cambio en la llamada de advertencia, que pasó a un tono más agresivo por parte del macho residente ante la aproximación del intruso. Aunque hasta ahora no se había informado de ninguna interacción física, el cambio en el tipo de llamada es similar al observado en otros *Gephyromantis*. El combate duró aproximadamente un minuto y durante ese tiempo cada uno de los machos trató de someter al otro, hasta que el intruso se retiró.

Palabras clave: Comportamiento agonístico, Llamada agresiva, *Gephyromantis*, Madagascar, Mantellidae

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## Resum

*Informe sobre interacció agonística en granotes de Malàisia del gènere Gephyromantis (Anura, Mantellidae).* Hi ha informacions sobre el comportament territorial de diverses famílies d'amfibis, però n'hi ha molt poques de referents a granotes de Madagascar, malgrat la diversitat extremadament alta d'espècies existent al país. Aquí es descriu l'enfrontament agonístic de dos mascles del gènere *Gephyromantis*, endèmic de Madagascar. El combat físic va anar precedit d'un canvi en la crida d'advertiment, que va passar a un to més agressiu, per part del mascle resident davant l'aproximació de l'intrús. Tot i que fins ara no s'havia informat de cap interacció física, el canvi en el tipus de crida es similar a l'observat en altres *Gephyromantis*. El combat va durar aproximadament un minut i durant aquest temps cadascun dels mascles va tractar de sotmetre l'altre, fins que l'intrús es va retirar.

Paraules clau: Comportament agonístic, Crida agressiva, *Gephyromantis*, Madagascar, Mantellidae

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## Introduction

Agonistic encounters have been recorded in a wide variety of frog species (Wells and Schwartz, 2007). To avoid risks and save energy, such interactions do not always result in physical confrontation, but physical aggression may occur when aggressive calls do not deter the intruder (Wells, 1977, 1978; Kluge, 1981; Martins et al., 1998; Abrunhosa and Wogel, 2004). A resident male frog is one who secures a certain area/territory, wherein he emits advertisement calls to attract females and deter other males from invading his display site. When an intruder male arrives, the resident may respond with various possible behaviours: abandon, stop calling, tolerate the intruder and keep calling, or confront the intruder (Robertson, 1986; Martins et al., 1998; Burmeister et al., 1999; Zank et al., 2008; Rosa and Andreone, 2012).

The genus *Gephyromantis* is endemic to Madagascar and composed of small to medium-sized frogs that generally live in rainforest leaf litter. Most individuals of this species seem to breed independently from water (to varying degrees), not engaging in amplexus during mating (Blommers-Schlösser, 1975; Glaw and Vences, 2007, 2011; but see Randrianiaina et al., 2007, 2011; Reeve et al., 2011). Despite the great diversity and interesting life history strategies within the genus (Glaw and Vences, 2006; Gehring et al., 2010; Crottini et al., 2011; Kaffenberger et al., 2012), these fairly abundant mantellid frogs are generally cryptic (Wollenberg et al., 2012; Vences et al., 2017), making observation difficult and resulting in few behavioural reports. Here we describe an episode of aggressive behaviour between two males of *Gephyromantis* sp. Ca25, an undescribed candidate species identified by Vieites et al. (2009).

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## Methods and results

The observation by G. M. Rosa took place on 4 December 2007, during a survey in Betampona Strict Nature Reserve in eastern Madagascar (Rosa et al., 2012), at a site locally called Betakonana (S 17° 54' 48.5", E 049° 12' 55.3", 317 m a.s.l.).

At about noon, a male (resident/defender) was spotted vocalizing (advertisement call; Rosa et al., 2011) on a leaf approximately 40 cm above the ground. A second male individual (intruder), positioned on the forest leaf litter, approached the area hopping, prompting a sudden intensification of the resident's call, that increased note repetition rate and consequently escalated towards an aggressive tone (aggressive call characterized by shorter inter-note duration and higher amplitude). The resident male then jumped to the ground (near the intruder) to confront him, emitting his loud call (fig. 1A). The intruder leapt towards the resident male, which eventually led to physical confrontation between the two (fig. 1B). During the combat, both males vocalized aggressively from time to time, while trying to subdue each other through body wrestling, consisting of grappling in an amplexus-like embrace (axillary and inguinal) (fig. 1B–1D). The attack also included jumps and landing on challenger's head and back (fig. 1C–1E). Vigorous kicks using the back legs were often used by both males to disrupt mounting attempts and simply to fend off the opponent (fig. 1E). The interaction went on for about a minute with physical engagement repeated several times until the intruder cowered (body and limbs horizontal and adpressed to the substrate). Backing off to about 30 cm distance with a single jump, the intruder retreated and eventually left the area.

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## Discussion

Agonistic behaviour similar to that reported here has been observed in several other species, such as dendrobatids and leptodactylids (Duellman, 1966; Wells, 1977; Abrunhosa and Wogel, 2004), but also in Malagasy frogs of the genus *Guibemantis* (Rosa and Andreone, 2012). Despite the lack of previous records of agonistic physical combat behaviour in *Gephyromantis* species, the observed change in call structure towards an aggressive vocalization seems to follow the overall pattern described for *G. thelenae* when resident males challenge territorial intruders (Wollenberg and Harvey, 2010).

The reasons behind this antagonistic interaction remain unclear. At the time of the observation, the calls of three conspecific males were also heard within a 30 m radius. Hence we infer that this could represent the defence of either a display site (e.g. being an elevated position to increase call transmission) or a resource-based territory.



Fig. 1. Agonistic interaction between two males of *Gephyromantis* sp. Ca25 in Betampona Strict Nature Reserve: A, resident male (darker frog with yellowish flanks) confronting the intruder (lighter frog) with an aggressive call before any physical contact; B–E, bodily engagement with both males attempting to subdue the opponent, through amplexus-like embrace (B, C) and hindlimb kicks (E). (Photos by G. M. Rosa).

*Fig. 1. Interacción agonística entre dos machos de Gephyromantis sp. Ca25 en la Reserva Natural Estricta de Betampona: A, macho residente (rana más oscura con los flancos amarillentos) haciendo frente al intruso (rana más clara) con una llamada agresiva previa al contacto físico; B–E, enfrentamiento corporal entre ambos machos con objeto de someter al oponente mediante un abrazo semejante a un amplexo (B, C) y golpes propinados con las extremidades posteriores (E). (Imágenes de G. M. Rosa).*

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