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Fighting behaviour in the Bicoloured frog *Clinotarsus (Rana) curtipes* Jerdon, 1854

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In anuran amphibians, access to calling sites may be one of the determinants of male mating success (Kadadevaru and Kanamadi, 2001). Male anurans typically establish and maintain territories by vocalising. When vocalisations do not succeed in warding off intruders into territories anurans may opt to settle territorial disputes with exaggerated movements and aggressive calls (Wells, 2007). When visual displays and aggressive calls are ineffective at warding off intruders some anurans will fight (see review in Martins et al., 1998, Wells, 2007). Herein, we report for the first time male-male combat in *Clinotarsus curtipes* (Jerdon, 1854).

Clinotarsus curtipes is a medium sized terrestrial frog endemic to the Western Ghats Mountains of south-western India (Daniels, 2005). They are sexually dimorphic in size, with females being considerably larger than males. The activity period and breeding season of *C. curtipes* coincides with the monsoon rains and lasts from June to September (Daniels, 2005, Krishna and Krishna, 2005A,B). These frogs breed in deep, perennial water bodies such as along slow-flowing streams and in water tanks with canopy cover and dams (Hiragond et al., 2001, Krishna and Krishna, 2005A,B; Gururaja pers. comm). Large numbers of frogs congregate around breeding sites after dusk and emit their advertisement calls from 1820hours until 0400hrs. Female *C. curtipes* have been documented vocalising from the same location at a breeding site over multiple nights (Krishna and Krishna, 2005A). Females who were still vocalising late in the breeding season and were holding territories were observed fighting and chasing off intruding females who arrived late at the breeding site and such fights were not recorded among

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Figure 1. The fresh water spring at ARRS. The location of the fighting behaviour.



Figure 2. Males *C. curtipes* posturing before fighting.

females who arrived early in the breeding season in the presence of many males (Krishna and Krishna, 2005A). Here we describe for the first time male-male combat in *C. curtipes*.

We made observations during the southwest monsoons on the 21st of July 2010 at 2140hrs in a freshwater spring surrounded by secondary evergreen forest (Fig. 1). The perimeter of the spring was approximately 65meters and 1.8meters at its deepest point. The spring was located at the Agumbe Rainforest Research Station (ARRS), Agumbe, Shivamogga District, Karnataka, India (13°31'N, 75°05'E, 550m asl). ARRS is a 3.2 ha area consisting of a Betel Nut (*Areca catechu*) plantation and fallow paddy fields bordered by secondary evergreen forest. Temperature ranges between 10–35°C and average annual rainfall is ca. 7000 mm/yr.

Supplementary video clips on male-male interactions are available at <http://amphibiaweb.org>.

We observed fighting between two male *C. curtipes* at the edge of a permanent spring which is a known *C. curtipes* breeding site. The males differed in size and were vocalising throughout the interaction. The vocalisations differed to the advertisement call that we were familiar with (for a description of the male advertisement call see Krishna and Krishna, 2005A). First the smaller male approached the larger male, both individuals tried to position themselves so that they were either displaying their chest or sides to one another (Fig. 2). Their interaction consisted of a series of press-up movements with each individual taking turns lifting the other off the substrate and throwing them off-balance. The largest male initiated the combat



Figure 3. Males of *C. curtipes* wrestling.

with press-up movements until the two males were within touching distance and nudging one another with each press-up. The larger individual then mounted the smaller individual, grasping him under the head and later behind the forearms; he jumped vertically lifting the smaller male from the substrate. Whilst in the air the larger male attempted, unsuccessfully, to twist the smaller one onto his back. The press-up display and nudging resumed once again. This time, the smaller male mounted the larger male trying to twist him onto his back but unsuccessfully (Fig. 3). This ended the fight; the small male retreated and moved away from the edge of the spring but continued his aggressive vocalisations. The entire interaction lasted 3.5 minutes. Female *C. curtipes* were not observed within a 10m radius of the fighting individuals.

We only witnessed one instance of male-male combat in *C. curtipes* in Agumbe and so we are unable to comment whether or not this is a common occurrence. Densities of *C. curtipes* at breeding sites were far lower in Agumbe than at other locales where the reproductive behaviour of this species has been observed (Daniels, 2005). In the month we were surveying the natural fresh water spring where the observation was made, no more than four male *C. curtipes* were seen together at a time.

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