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Two remarkable prey items for a chicken: *Leptodactylus fallax* Müller, 1926 predation upon the theraphosid spider *Cyrtopholis femoralis* Pocock, 1903 and the colubrid snake *Liophis juliae* (Cope, 1879)

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Published records of amphibians preying on either large spiders or snakes in the wild are rare; this note documents predation by individuals of one amphibian species on both large spiders and snakes. Mountain chicken frogs (*Leptodactylus fallax*), which are amongst the largest frogs in the world, were observed successfully consuming the theraphosid spider *Cyrtopholis femoralis* on two occasions and attempting to consume another one on a further occasion on Montserrat. They were also found to have consumed the colubrid snake *Liophis juliae* on Dominica. This is the first theraphosid and the fourth snake species identified in the diet of *L. fallax*, and this frog is the first confirmed predator of *C. femoralis*.

Keywords: Colubridae; diet; Dominica; Leptodactylidae; mountain chicken; Montserrat; Theraphosidae; trophic relationship

Records of spiders preying on amphibians are fairly common in scientific literature, even in larval stages. Wolf spiders and tarantulas are among the main frog predators within the Araneae (e.g. McCormick and Polis 1982, Menin et al. 2005; Schulze and Jansen 2010). The opposite scenario appears to be much rarer, however, with very few and only vague records in peer-reviewed papers of predation events by anurans upon large spiders (e.g. Toft 1980).

Accounts of snakes preying on amphibians are also common in scientific literature and in some areas snakes may be the most significant amphibian predators (see review in Wells 2007). Conversely, anurans have only rarely been recorded to feed on snakes (e.g. Branch 1976; Schwartz and Henderson 1991; Duellman and Lizana 1994; Buley 2003), with most remarkable cases of predation upon reptiles being reported for the voracious *Lithobates catesbeianus* (Shaw, 1802) (e.g. Adams and Pearl 2007).

The “mountain chicken” (*Leptodactylus fallax* Müller, 1926), family Leptodactylidae, is among the world’s largest anurans, with adult females reaching a snout-vent length

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(SVL) of 210 mm and a weight up to 1000 g. Regionally endemic to the Lesser Antilles, this species was once found on at least six islands, but is now extant only on Montserrat and Dominica (Lescure 1979; King et al. 2005; Hedges and Heinicke 2007). Several factors are responsible for this decline, including habitat loss, overhunting and the introduction of alien predators. The recent introduction of the amphibian chytrid fungus, *Batrachochytrium dendrobatidis*, to these two islands has caused a dramatic decline in the remaining populations (Hedges 1993; Kaiser 1994; Garcia et al. 2007; Malhotra et al. 2007; Martin et al. 2007; pers. obs.). *L. fallax* is now listed as “critically endangered” by the International Union for Conservation of Nature (Fa et al. 2010).

Mountain chickens are terrestrial forest-dwellers and are nocturnal, spending the daytime hidden in burrows and crevices between rocks. A study by Brooks Jr. (1982) on the diet of *L. fallax* on Dominica showed that the species feeds mainly on invertebrates; primarily crickets, although millipedes, coleopterans and gastropods were also important prey groups. Additionally, centipedes, decapods and small arachnids were present in stomach contents, as well as several unidentifiable groups of invertebrates. Mountain chickens also occasionally prey on vertebrates including small eleutherodactylid frogs, the snake *Alsophis manselli* Parker, 1933, various *Anolis* lizard species, small *Boa constrictor nebulosa* (Lazell, 1964), *Typhlops dominicana* Stejneger, 1904, and even bats (Brooks Jr. 1982; Schwartz and Henderson 1991; Buley 2003). Here we present two new records in the diet of *L. fallax* in Montserrat and Dominica, namely the theraphosid spider *Cyrtopholis femoralis* Pocock, 1903, commonly referred to as the Montserrat tarantula, and the colubrid snake *Liophis juliae* (Cope, 1879).

Cyrtopholis femoralis is endemic to Montserrat and belongs to the family Theraphosidae, a group of hairy and often very large arachnids (Pocock 1903; Petrunkevitch 1911). In forested areas of the island, these tarantulas can be seen walking on the leaf litter or hidden in their terrestrial burrows, waiting to ambush passing prey. Although abundant, the biology of *C. femoralis* is poorly known (Carter 1997; Escoubas and Rash 2004), and there is very little detailed data on this species' natural history and ecology.

Liophis juliae, commonly referred to as Julia's ground snake, is a medium-sized colubrid snake (maximum SVL 627 mm) endemic to the Guadeloupe Archipelago and Dominica. It occurs in a variety of habitats, although it is not found at the highest elevations on the islands (Schwartz and Henderson 1991; Malhotra et al. 2007).

Three observations of *L. fallax* interacting with *C. femoralis* were made during research work carried out on the island of Montserrat (Leeward Islands of the Lesser Antilles in the Caribbean Sea) in 2009 and 2011. The events were observed along the Fairy Walk Ghaut (stream), in the Centre Hills (740 m above sea level). The Centre Hills are the largest remaining forested area on Montserrat, and contain the majority of the island's biodiversity (Young 2008; Holliday 2009). The Fairy Walk transect is part of a network used to monitor the *L. fallax* population, and individuals can be seen and heard along this transect during the rainy season (Garcia et al. 2007; Young 2008). Frogs were measured as part of the ongoing study.

The first observation occurred on 28 August 2009 at 23:55. An adult individual of *L. fallax* (160 mm SVL) was found approximately 15 m downstream of the beginning of the transect (16°45'4.48"N, 62°10'22.63"W) and 10 m from the stream (Figure 1A). When we approached the frog, it had an individual of *C. femoralis* (body length approximately 40 mm, excluding leg span) inside its mouth, and four legs were hanging out (Figure 1B and C). The *L. fallax* individual was immobile on the leaf litter; two dismembered spider legs on the ground near its arm suggest that the frog probably used its hand to push the prey into its mouth (Figure 1A). After swallowing twice, the tarantula was completely

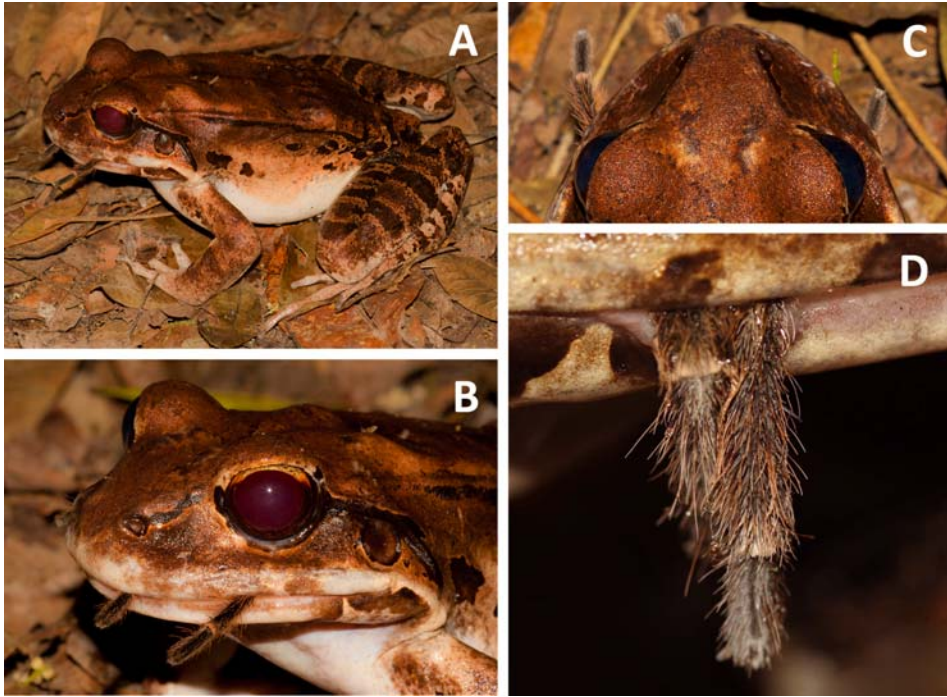


Figure 1. Predation of *Cyrtopholis femoralis* by the mountain chicken frog, *Leptodactylus fallax*, observed at the Centre Hills, Montserrat (Lesser Antilles): (A) post-capture moment of mountain chicken upon on a tarantula; (B) frog with the *C. femoralis* individual inside its mouth; (C) upper view showing tarantula's legs; (D) detail of two tarantula legs hanging over the *L. fallax* jaw. (A)–(C) took place on 28 August 2009; (D) took place on 9 September 2009. Photos by Gonçalo M. Rosa.

consumed (approximately four minutes after the frog was first observed with the spider in its mouth).

The second event was recorded on 9 September 2009 at 20:00. Another adult mountain chicken (140 mm SVL) was spotted sitting less than 7 m from the stream (16°45'9.65"N, 62°10'50.98"W). A *C. femoralis* (approximately 35 mm body length) was slowly walking towards the frog on the leaf litter when it was suddenly snapped up. This “sit, wait, and grab” predation strategy has already been suggested by Brooks Jr. (1982). The sequence of events following capture was similar to those previously described: initially there were the terminal portions of several tarantula legs hanging out of the frogs mouth (Figure 1D), and it took the frog four swallows and approximately six minutes to finish consuming the tarantula. As with other voracious anurans, the prey that a mountain chicken can consume will be largely limited by the gape of its jaws and the distension of its stomach (Tyler 1975).

The third observation was on 7 January 2011 at 20:30 in Sweet Water Ghaut (16°46'52.97"N, 62°11'8.10"W). Captive bred frogs had been released one week earlier and were being monitored daily. A young adult mountain chicken (120 mm SVL) was spotted actively chasing a *C. femoralis* (approximately 35 mm body length), which exhibited defensive behaviour, raising its pedipalps and anterior two pairs of legs (see Petrunkevitch 1926). After several approaches by the frog, the tarantula successfully made a rapid escape avoiding being captured.

Regardless of their size and fearsome reputation, tarantulas are also eaten by several other vertebrate groups (e.g. Nieves 2007). Their neurotoxic venom affects different taxa



Figure 2. A 45-mm-long body portion of *Liophis juliae* found in faecal material of an adult female *Leptodactylus fallax* from Dominica. Photo by Benjamin Tapley.

in different ways, causing a variety of symptoms (Baerg 1925; Escoubas and Rash 2004), but no studies on the effect of tarantula venom on anurans have been conducted to date. Nevertheless, being venomous clearly does not prevent some species, including *L. fallax*, from preying on them. It is worth noting that *L. fallax* is in fact the first confirmed predator of the Montserrat tarantula.

The observation of an *L. fallax* preying on *L. juliae* was made during research work carried out on the island of Dominica in October 2011. An adult female mountain chicken had been collected from the south of the island and brought into the mountain chicken captive breeding facility in Roseau. Several days after capture, this specimen passed faeces containing a 45 mm length of the snake *L. juliae*. The only other similar sized snake on Dominica is *Alsophis sibonius*. *A. sibonius* has two apical pits on each scale (Schwartz and Henderson 1985) and these were lacking on the snake remains obtained from the faecal sample (Figure 2). The mountain chicken had not been fed since it arrived at the facility as the author (B. Tapley) wished to see what it had been feeding on prior to its capture; *L. juliae* therefore forms part of the natural diet of wild mountain chickens.

This manuscript is the first documented record of predation on a tarantula species by *L. fallax*, and it adds *C. femoralis* to the list of prey species for this frog. Another member of the Theraphosidae family occurs in Dominica. However, no instances of predation by *L. fallax* on *Avicularia versicolor* (Walckenaer, 1837) have been reported (Nicholas 1998), making this a phenomenon unique to Montserrat. Further studies to fully understand the interactions between these two giants of Montserrat would be very useful, and could contribute to their conservation.

The Montserrat population of *L. fallax* has been recorded feeding on colubrid snakes (Buley 2003) and boid snakes had previously been recorded in the diet of mountain chickens on Dominica (Schwartz and Henderson 1991); however, the observation of a *L. fallax* consuming *L. juliae* represents the first record of its kind for Dominica. We thus suspect that *L. fallax* consumes other snakes that occur in its range, namely *Typhlops monastus* Thomas, 1966 on Montserrat and *Alsophis sibonius* Cope, 1879 on Dominica.

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