

SHORT COMMUNICATION

# Evidence for parental care in *Feihyla kajau* (Anura: Rhacophoridae)

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**Palavras-chave:** anuros, Borneo, convergência, cuidado maternal, nidificação em gel, ninhada.

Rhacophoridae is a large (419 species) family of Old World tree frogs that have a variety of reproductive modes (AmphibiaWeb 2018). They reproduce by aquatic breeding, direct development, or laying eggs in foam nests or terrestrial “gel nests” (Meegaskumbura *et al.* 2015). The basal state to direct development and foam nesting in rhacophorids may be gel-nesting, in which terrestrial eggs are sheathed in a thick jelly (Meegaskumbura *et al.* 2015). *Feihyla kajau* (Dring, 1983), a Bornean endemic (Inger *et al.* 2004), is the only representative of the exclusively Southeast Asian genus *Feihyla* found on the island (Hertwig *et al.* 2013, AmphibiaWeb 2018). Like other rhacophorids with arboreal gel nests, *F. kajau* is relatively small and lays small egg clutches (Meegaskumbura *et al.* 2015). To date, there is no available information on parental egg attendance in this species.

*Feihyla kajau* is remarkably similar to Neotropical glass frogs (Centrolenidae) in both appearance and behavior, despite the phylogenetic distance between them. The resemblance of these taxa may be an example of convergent evolution between distantly related species that occupy a similar niche space. Like centrolenids, *F. kajau* is a small, arboreal frog that deposits gel-encapsulated eggs on vegetation overhanging streams (Figure 1); after hatching, the tadpoles complete development in the water (Ruiz-Carranza and Lynch 1991, Das *et al.* 2016). Centrolenids exhibit post-zygotic parental care of eggs after they are deposited (Vockenhuber *et al.* 2009, Delia *et al.* 2013, 2017)—a behavior heretofore unknown in *F. kajau*. Here we describe apparent parental care in *F. kajau*.

Observations were made on 29 August 2014 in Sabah, Borneo (04°57'56.1" N, 117°48'09.1" E, WGS 84, 163 m a.s.l.). At 21:24 h, an amplexant pair of *F. kajau* was observed on the underside of a leaf (Figure 2A). Returning to the site 53 min later, we observed that the female had remained with the eggs, clasping them with

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her back feet (Figure 2B), but the male frog was not present. Multiple egg clutches at different stages of development were observed at this same site on five separate visits; however, no other parental care was observed.

Possibly, *F. kajau* only attends the eggs for a short time after oviposition, as do some centrolenids that only brood for the remainder of the night of oviposition (Delia *et al.* 2017). Among glass frogs with first-night only care, it is the females who attend the eggs (Delia *et al.* 2017). Our observation of a female *F. kajau*, then, remains consistent in its parallel to Centrolenid behavior.

Behaviors such as egg attendance and brooding have been repeatedly linked with egg survival in a wide range of gel-nesting species

(Vockenhuber *et al.* 2009, Poo and Bickford 2013, Delia *et al.* 2013, 2017). Post-fertilization parental care has been recorded in approximately one tenth of frog species worldwide (Lehtinen and Nussbaum 2003). Although parental care remains sparsely recorded in Southeast Asian frogs (Poo and Bickford 2013), it is known in species closely related to *F. kajau*, such as *F. (Chiromantis) hansenae* (Cochran, 1927) (Sheridan and Ocock 2008, Poo and Bickford 2013) and *F. vittata* (Boulenger, 1887) (Wan *et al.* 2012). In these three species, the parent positions the posterior portion of its body and hind legs over the egg clutch.

Arthropods, including katydid, ants, and wasps, are significant predators on gel-nesting frogs, accounting for as much as 90% of egg

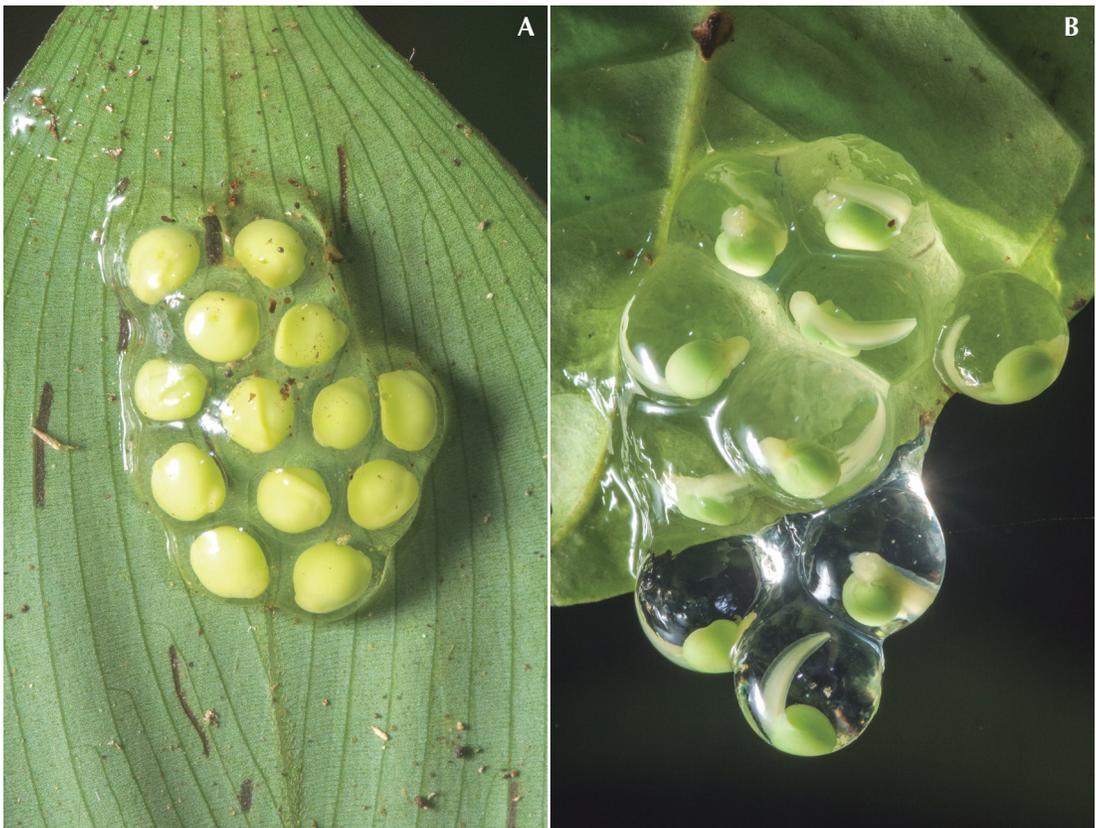


Figure 1. Eggs of *Feihyla kajau* at varying levels of development. (A) A younger clutch. (B) A more developed clutch.



**Figure 2.** (A) A pair of *Feihyla kajau* in amplexus on the underside of a leaf in Sabah, Borneo. (B) The female remains, attending the eggs and clasping them with her hind feet.

mortality (Vockenhuber *et al.* 2009, Poo and Bickford 2013, Delia *et al.* 2017). There are no records of arthropods depredate eggs of *F. kajau*, but signs of invertebrate predation have been observed in egg clutches of *F. kajau* proximal to the present observation (A. Sorokin pers. obs.). In the closely related *F. hansenae*, there is intense arthropod predation pressure, which is the single largest cause of egg mortality (Poo and Bickford 2013). However, even a brief period of egg attendance can increase egg survivorship. In centrolenids, just a few hours of brooding provides eggs with days of protection against arthropods (Delia *et al.* 2017). Furthermore, brooded eggs are more likely to avoid desiccation during a dry period of weather, another principal cause of mortality for developing eggs. Attending parents hydrate their eggs through fluid transfer by contact with a

highly vascularized patch below their pelvis (Delia *et al.* 2013, 2017).

We still have much to learn about frog parental care, especially the tradeoffs shaping the evolution of this complex behavior. Little is known about this behavior in Southeast Asian frogs, with this note being the only observation in *F. kajau*. Further investigation of breeding in this species, particularly continuous observations immediately following oviposition, must be conducted to confirm that the behavior here observed constitutes parental care.

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