

Research Article

The Husbandry and Captive Reproduction of The Gliding Leaf Frog *Agalychnis spurrelli* (Boulenger 1913)

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INTRODUCTION

The recently reviewed genus *Agalychnis* (Faivovich 2010) comprises fourteen species of charismatic leaf-sitting nocturnal hylids distributed throughout most of Central and northern South America. Usually characterised by brightly coloured flanks and irises, all members of this genus are also arboreal and deposit their eggs above temporary or permanent bodies of water attached to overhanging vegetation or roots. Although found to reproduce more frequently during the rainy season, *Agalychnis* are opportunistic and in some instances spontaneous and explosive breeders (Scott & Starrett, 1974; Roberts, 1994). It appears some may emerge to reproduce given any opportunity; *A. callidryas* has even been observed reproducing after periods of no rain at all, providing there is a suitable body of water to utilise (pers. obs.). However, besides the Red Eyed Tree Frog, *A. callidryas*, this genus is relatively poorly represented within captivity. This paper describes captive reproduction in *A. spurrelli*.

A. spurrelli (Boulenger, 1913) occurs over a large range of Central and northern South America including Costa Rica, Colombia, Panama and Ecuador, from sea level to 880 m (Duellman, 1970). Known for its parachuting, or gliding ability, it has been reported to breed in unusually large aggregations around temporary or permanent bodies of water after periods of heavy rainfall (Scott & Starrett, 1974). In the wild, the tadpoles of this species

have been observed schooling like fish and congregating in areas that receive more light (Gray, 1997). *A. litodryas* is now considered a synonym of *A. spurrelli* after phylogenetic research (Faivovich, 2010); it is now considered a variant of *A. spurrelli* which lacks orange coloured flanks. This species is identified as having a maroon coloured iris, usually orange flanks, a green dorsum and a white ventral surface. Also characteristic are irregular white spots on the dorsum, bordered with black, unique to each individual although some may lack it altogether. Full webbing of the hands and feet is used to perform the gliding behaviour typical of this species (Duellman, 1970). The following husbandry and captive breeding recommendations have been produced following a number of successful reproductions throughout 2012.

METHODS

The adult group of *A. spurrelli* consisted of six males and four females that were housed within a well-ventilated glass vivarium measuring L 90 cm x H 60 cm x W 45 cm. Temperatures ranged between 22°C - 27°C. A humidity of 65% - 75% when being maintained outside of breeding conditions was ideal. A large shallow water dish and a heavy misting in the evening shortly before the lighting was switched off achieved this. A 12/12 photoperiod was given and the frogs were maintained using 6% UVB T5 lighting. Appropriately sized crickets were fed 3-4 times per week, providing up to two or three



Figure 1. Amplexant pair of *A. spurrelli* within the rain chamber.

food items per individual. All food items were dusted with a vitamin and mineral supplement such as Nutrobal or Repashy Calcium Plus and gut loaded using fresh fruit and vegetables.

The vivarium was furnished with live potted plants such as *Monstera deliciosa*, *Spathiphyllum* sp. and *Ficus* sp.. These plants provided resting areas and shelters for the frogs as they sleep during the day (although they often used the glass walls of the vivarium). The long stems of *M. deliciosa* also provided walkways for these highly arboreal amphibians. Additional branches were also included to provide more climbing space.

Although it is possible to maintain these frogs in natural planted vivaria with a soil based substrate, it was decided to leave the base of the vivarium bare. Instead of a substrate, the frogs were provided with an area of moist paper towel placed next to a large shallow water dish. This was replaced daily along with cleaning all surfaces within the vivarium and the removal of any waste. A routine such as this is the key to maintaining and reproducing *A. spurrelli* long term. The enclosure was fully cleaned daily with little or no disturbance to sleeping frogs, which provided the opportunity for close

observation, and any problems were likely to be noticed almost immediately.

Upon deciding that the frogs were in adequate condition to attempt breeding, the group was moved into a large rain chamber measuring L 125 cm x H 76 cm x W 60 cm. Adequate space was required to create distance between calling males. The rain chamber was furnished with climbing branches and *Monstera* sp.. The base of the rain chamber was filled with 10 cm of cool water; this was to aid a brief cooling period of two days which created air temperatures of between 15°C - 20°C. During this period the frogs were not fed and water in the chamber was replaced daily. Activity was decreased during this time.

After the brief cooling period, on the morning of the third day, a water heater was switched on within the chamber, heating the water to 25°C. This coincided with partially covering the ventilation on the roof of the vivarium. As the water warmed and the humidity began to increase, a pump within the rain chamber was switched on circulating the water as artificial rain. This rapidly increased the temperature to approximately 25°C and the humidity to above 80%. This artificial rain remained during daylight hours and was switched off during the night when the frogs became active. Electronic timers may be used to control heaters and pumps but in this instance they were controlled manually.

RESULTS

During the period of observation the frogs maintained a high level of health and over time came into breeding condition. Indicators of this were the possession of nuptial pads in males and females looking particularly large. After being exposed to the above environmental changes, males became incredibly active, vocal and competitive. They were observed competing amongst one another and followed females around the vivarium throughout the night. Amplexus between at least one pair was achieved after the first night (Fig.1), but may have taken up to four days of consecutive rain for amplexus and/ or spawning to be achieved. In some instances pairs spawned after only one day of rain.

The eggs were laid in a single layer and during spawning were deposited in single or



Figure 2. Eggs deposited on a *Monstera* leaf.

paired rows close together. They lacked the large gelatinous mass seen in other *Agalychnis* sp.. Instead, they were encased within a thin but rather rubbery and tough membrane (Fig. 2) Eggs produced by one female in a single spawning numbered as many as 110. On one occasion, egg deposition was observed during the early hours of the morning, beginning at approximately 5 am and continuing to 7.30 am. When pairs finished, they immediately separated. Eggs were deposited on any smooth and stable surface within the rain chamber including the *M. deliciosa* leaves, the glass walls of the chamber and on the sides of plant pots. During the process of spawning the pair, guided by the female, repeatedly visited the water in the base of the chamber to submerge her ventral surface before returning to the egg mass. Interestingly, upon returning, they then continued to deposit eggs adding to the row that they had previously left, giving the impression of a continuous row of eggs.

The eggs developed and hatched into free-swimming tadpoles within 7 – 9 days. Tadpoles were generally unproblematic to raise to metamorphosis. Water temperatures from 23°C - 26°C were provided, an air stone was also provided to gently aerate the water. No filtration was required and regular partial water changes were made. Metamorphosis was achieved at approximately six to nine weeks, with individuals of the same group leaving the water at varying times. Young frogs were housed in small plastic faunariums furnished with a *M. deliciosa* leaf, climbing branches, a substrate of moistened paper towel and a shallow water dish.

Food was provided up to twice a day in amounts that would be eaten within a short

period of time. The tadpoles had particularly large appetites and were fed a mixture of tropical fish flakes, sera micron, spinach leaves, and small amounts of bloodworms were also eaten on occasion. Tadpoles were raised in groups in an attempt to replicate the natural behaviour of the species. The young frogs began feeding 7-10 days after leaving the water and full metamorphosis was completed. They varied in size from 1.5 cm – 2.5 cm and were capable of consuming 1st and 2nd instar crickets from their first feed.

DISCUSSION

A common misconception regarding captive breeding in most tropical amphibians is the requirement for distinct wet and dry seasons. Although this may be true for many species it appears not to be the case with *A. spurrelli*. Creating a ‘wet season’ in order to stimulate *A. spurrelli* to reproduce in captivity would maintain the frogs within a stressful environment for a prolonged period of time. This may eventually lead to weight loss and bacterial infections due to the constant wet conditions and high level of activity.

A. spurrelli is potentially a large species, with females being larger than males. Although size may vary greatly between individuals from different localities, a large female may measure 92.8 mm snout to vent (Duellman, 1970). This should be taken into consideration to ensure appropriate captive management of the species. It is possible that males from one locality may not be capable of reproducing with females from another locality due to the huge discrepancy in size. Keeping multiple males and mixed sexes together did not seem to be problematic when they were being maintained outside of breeding conditions. Competition or aggression between males was not observed during regular conditions; only rarely would a male amplex with a female outside of the rain chamber (see below) and should this occur the pair would separate within a day or two.

An instance where any *Agalychnis* sp. have spawned when outside of the rain chamber environment has not been noted. A pair joined in amplexus during regular conditions only served as an indicator of willingness to breed (and usually just of an over eager male!), or perhaps that they were being maintained slightly

too wet. Keeping *A. spurrelli* too wet gives the frog's only half of the cue they require to reproduce; which can subsequently result in a pair ready to spawn but unable to find an appropriate area to do so.

Due to the spontaneous nature of reproduction in this species, breeding may be attempted at any time of the year providing that the animals are in adequate condition and that breeding poses no risk to their health. Successful reproduction relied upon creating a clear distinction between the usual environment and a warm, humid and wet rain chamber. A sharp increase in humidity was essential in encouraging reproductive behaviour.

Once spawning was accomplished all frogs were removed and placed back into their regular vivarium. In most instances the eggs remained within the rain chamber for the duration of their development. It was an option to remove leaves containing eggs and suspend them in containers above a small amount of water for the hatching tadpoles to drop into. Although it seemed more beneficial to leave the eggs where they were deposited within the rain chamber where the conditions remained humid, warm and more constant. Egg scraping behaviour performed by competing males as observed by Scott and Starrett (1974) has not yet been observed in the captive environment.

The care guide for the young was generally the same as for the adults. Housing and food size were adjusted according to growth; it was found that young frogs had large appetites and required feeding almost daily to maintain a healthy body condition. Adult size and maturity can be expected to be achieved from 12 – 18 months of age when raised in optimum conditions. The young of this species lack the full webbing of the hands and feet as seen in the adults; this is developed during growth.

The method described here is ideal for breeding species, which do not require distinct seasons, as it takes advantage of the spontaneous nature of their reproduction. The frogs need only to be within a rain chamber for seven days or less. In attempts at breeding several *Agalychnis* sp. the frogs have never been subjected to more than five days of rain before spawning; if no eggs are deposited after this time they are simply placed back into their normal routine and tried again some weeks later. In the long term these methods are beneficial to the health and longevity of *Agalychnis* sp. in captivity.

REFERENCES

- Duellman, W.E. (1970). *Hylid Frogs of Middle America*. Society for the Study of Amphibians and Reptiles. Ithica, New York.
- Faivovich, J., Haddad, C.F.B., Baêta, D., Jungfer, K.H., Álvares, G.F.R., Brandão, R.A., Sheil, C., Barrientos, L.S., Barrio-Amorós, C.L., Cruz, C.A.G., Wheeler, W.C. (2010). The phylogenetic relationships of the charismatic poster frogs, Phyllomedusinae (Anura, Hylidae). *Cladistics* 26: 227-261.
- Gray, A.R (1997). Observations on the biology of *Agalychnis spurrelli* from the Caribbean lowlands of Costa Rica. *The Herpetile* 22: 61-69.
- Roberts, W.E. (1994). Explosive breeding aggregations and parachuting in a Neotropical frog, *Agalychnis saltator* (Hylidae) *Journal of Herpetology* 28: 193-199.
- Scott, N.L. & Starrett, A. (1974). An unusual breeding aggregation of frogs, with notes on the ecology of *Agalychnis spurrelli* (Anura: Hylidae) *Californian Academy of Sciences* 73: 86-94.