# Breeding Brongersma's Toad, *Bufo brongersmai*

Sergé Bogaerts
Honigbijenhof 3
NL-6533 RW NIJMEGEN
The Netherlands
s.bogaerts@hetnet.nl

## INTRODUCTION

In 1998 I received some *Bufo brongersmai* from two German fellow-herp enthusiasts. This species of toad is very easy to maintain and to breed in captivity. The latter is especially rare among true toads of the genus *Bufo*. In addition, this is a very beautiful and interesting animal that does not require much space. This combination of factors makes *B. brongersmai* an ideal terrarium animal. Since one pair produced several hundred eggs, I was able to distribute larvae among different serious hobbyists. My motivation was that the offspring would be cared for properly and I would be able to compare the results. Through the exchange of information I was able to write a decent report on how to raise these toads. In this article I would like to present the reader with a general description of this toad and the results of rearing these animals under different conditions.

## DESCRIPTION

Brongersma's toad was only described in 1972 (HOOGMOED, 1972). The animal is named after the Dutch herpetologist Dr. L.D. Brongersma, who is mostly known for his work on marine turtles. The holotype of this toad (RMNH 16782) was collected roughly 10 km southwest of Tiznit, on the road from Tiznit to Mirhleft, in Morocco. This species, discovered on two collecting trips in the months of March, April, and May 1971, is described as follows:

A small-sized *Bufo*, greyish brown with rather small green spots on its back. The interorbital space is always wider than the width of an upper eyelid. In adult specimens the head is more than twice as long as it is deep. The parotoids are small, slightly longer than wide, almost round.

Two *Bufo brongersmai* basking between the rocks.

Photo: S. Bogaerts

As well, Hoogmoed (1972) reported that the most distal tubercle underneath the fourth toe is double. However, this particular characteristic is not very useful in the field (BENHACHEM, 1989 in: BONS & GENIEZ, 1996). He also reported that males and females can be distinguished by comparing the extent of skin-like webbing between the toes of the animals. In males the webbing reaches the tip of the toes, whereas it is less extensive in females. This sexual dimorphism also occurs in, for example, *Bombina maxima* (see e.g. BOGAERTS, 2000). In addition, males can be recognised by nuptial excrescences on the front limbs (on the first three toes). Beyond the mating season these are not black, but still remain recognisable.
Also, the green spots of the male colour pattern generally contrast less with the background colour, their front limbs are relatively heavily built, and the head is fairly large. According to HOOGMOED (1972) the spines on the dorsal warts are more pointed in males than in females. I have only been able to discern this characteristic during the mating season and I presume that it is a nuptial feature. The maximum size that he reports for males is 51 mm, for females 48 mm. My animals are all smaller.

## MY ANIMALS

Adult 'white' male *Bufo brongersmai*.

Photo: S. Bogaerts

The animals that I maintain originate from two separate imports. For the sake of convenience I will call them the 'white' animals and the 'red' animals (since one group has a white/tan dorsal coloration and the other animals are reddish-brown). The white animals originate from a breeding group owned by a Mr. Laubner from Dresden. These animals are already third or fourth generation captive offspring (F3 or F4). This bloodline probably stems from the Sous Valley area near Agadir in western Morocco. The red animals I obtained from Mr. Ralf Liebetrau. These were originally bought in the pet trade and, according to the dealer, they were collected near the terra typica. The animals I received were F2 (second captive-bred generation). It is striking that the white animals remain smaller than the red ones. In addition, the white animals do not have spots on the belly. Of course, both pattern and size differences can be caused by variability within this species, but it is possible that it is caused by the limited genetic diversity within the captive breeding population.

Adult 'red' female *Bufo brongersmai*.

Photo: S. Bogaerts

## DISTRIBUTION

The author of the original species description (HOOGMOED, 1972) suspected that this species was endemic to southwestern Morocco, roughly from Tiznit to Tarfaya, and from there to the west coast (Cape Bojador, also known as Cape Boujdour, Spanish Sahara). This is an area that mostly consists of rocky desert and semi-desert. Since the original description of this species, its distribution range has turned out to be much bigger: reaching the southern Atlas near the Algerian border. There is a chance that the endemic status of this animal will be dropped since it has also been found in the Draa Valley, southeast of Ouarzazate (BONS & GENIEZ, 1996) and even north of the High Atlas (north of Marrakesh) (BONS & GENIEZ, 1996).

## HABITAT

The natural history of this species is poorly known. Since I have never seen these animals in the wild and there is little information available, I have cited the original species description. Habitats vary from a hilly area with scattered rocks, boulders and lots of grasses, to an outright desert habitat with sparse vegetation. These animals are mostly found under semi-arid conditions with relatively little vegetation. The vegetation mostly consists of *Argania* and *Euphorbia* species and grasses. The elevational range of these toads varies from 171 m in Souk el Arba du Sahel to 1,000 m in Tafraoute. Hoogmoed (pers. comm.) wrote me that the ponds used for reproduction were located in rocky areas. One of the ponds was roughly 20 m across, and the water did not appear to contain any vegetation. The temperature of the water must have varied considerably between day and night. The pond was located in an open area and the sun could heat up the water during the day, while at night most of the heat would radiate from the water. During that time (March) the sun was not yet very powerful. In the Oued Seyad (to the east of Fask) *B. brongersmai* was found together with *B. viridis.* BONS & GENIEZ (1996) report that these species co-occur often, especially in the western part of the distribution range of *B. brongersmai*.

## THE TERRARIUM

Initially, I kept these animals in a rocky semi-desert terrarium measuring 90x45 cm. Fourteen animals were maintained in this setting. One part of the terrarium was filled with flat rocks that were stacked loosely with large holes in between. A 25-Watt reflector light provided localised heat and lighting. The bottom substrate in this section consisted of fine gravel. The other half of the terrarium was not heated, had a loam bottom substrate, and contained stacks of rocks. This section also contained a small waterbasin that was cleaned and refilled every other day (the toads like to defecate in the water). This section of the terrarium was sprayed with water once a week. During the day, the temperature was approximately 25-30°C and at night roughly 15°C. Food consists mainly of buffalo worms and small crickets, dusted with a vitamin and calciumcarbonate mixture (Korvimin).
Later, I started keeping these animals in smaller groups in smaller terraria (about five animals to a 30x40 cm terrarium). The decoration of these small terraria was identical to the larger ones. The large terrarium turned out to be difficult to inspect and on one occasion a dead animal was not discovered in time and caused several others to die shortly thereafter (see paragraph on diseases).

## BEHAVIOUR

These toads are often active during the day. In the terrarium, they bask during the day by sitting fully exposed underneath the spotlight or by crawling in cracks between the rocks. They are often located beneath the highest rock in the pile – hence the warmest location. Once active, they rapidly escape between the rocks when disturbed. HOOGMOED (1972) found these toads during the day usually under rocks. In a shallow puddle located next to a streambed in a desert environment, the animals were seen in early morning sitting in the water, facing the river. When approached, they slid backwards into the mud. It had rained on the night before this discovery and it was cloudy the next day. A few days later the same location was revisited but no toads were observed sitting in the water. Probably, they were all males that were waiting for females. In the terrarium males can also be found sitting in the water during the day in the mating season.

Beyond the mating season these animals can be seen frequently searching for food during the daylight hours, but their main activity period is at night. When moving about in the terrarium little climbing expeditions are undertaken frequently.
These toads have a relatively high need for water. They absorb water through the skin of their thighs and underbelly (which are almost transparent in places). I have observed a similarly thin skin in *Bufo mauretanica*. When eating, they almost invariably use their tongue and they do not snap at their prey (M. Sparreboom, pers. comm.). Upon approaching a prey item, these toads display a vibrating motion with the long toes on their hind limbs. I have personally observed this phenomenon in adult animals, but juveniles are known to do this as well (R. Veen, pers. comm.).

## VOCALISATIONS

HOOGMOED (1972) reported that he heard an animal call from underneath a rock, but thought it unlikely to be the mating call, since it was a short call that did not resemble the rolling call of *Bufo clamitans* or *Bufo viridis.* Unlikely as it may be, I still suspect that this was indeed the mating call of *Bufo brongersmai*. Similar vocalisations are heard in the terrarium during the mating season. Juveniles measuring approximately three centimetres already produce these calls. The vocalisations do not resemble those of either *Bufo clamitans* or *Bufo viridis*, but are more like the call of *Hyla arborea* – albeit less loud and with a lower frequency. It sounds much like 'kèèk-kèk-kèk-kèk-kèk-kèk-kèk', with the first 'kèk' being somewhat longer and the remainder of the call following in rapid succession. Call bouts last for 1-2 seconds. In addition, females produce release calls.

## REPRODUCTION

Amplexus of a 'red' pair of *Bufo brongersmai*.

Photo: S. Bogaerts

These toads reproduce in early spring. The males can be heard calling regularly during the winter months, and the females are already fat. For breeding I use a separate terrarium (following the advice of Ralf Liebetrau). This terrarium is filled with water to a depth of about 5 cm. I place a few emerging rocks in the water, which the toads can use to hide between. The water is heated with an aquarium heater (water temperature during the day 25°C, and 15°C at night - Liebetrau heated the water as high as 30°C). The aquarium is for the most part covered to create a high relative humidity. Two males are placed in the aquarium. The males are selected on the basis of the presence of nuptial excrescences on the front limbs. After a day or two, a gravid-looking female is added into the aquarium. I usually leave this female in for one week at the most. If no amplexus has taken place by then, or no eggs have been laid, the female is returned to her original terrarium and replaced by another female. If amplexus is taking place, the second male is removed in order to minimise the stress on the pair. Previous research has shown that these toads produce two strands of eggs, each containing a single row of eggs. The length of each strand is approximately 2 meters. The larvae hatch at a length of 5.3-5.8 mm (GRILLITSCH et al., 1989).
Altogether, four amplectic pairs were formed in the year 2000, resulting in three egg clutches. The chronology of these events was as follows. Starting January 1, 2000 the animals were placed in the aquarium. Amplexus took place on January 14. At that time, the animals were still on land. Occasionally they would swim around in amplexus. On January 16, I raised the water level somewhat (about two cm). The following day I discovered a clutch of eggs of this (white) pair. The eggs were removed from the aquarium with the aquatic vegetation still attached, and placed in a separate aquarium.
A different (red) pair was placed in the aquarium. A second clutch was produced on January 18. This was laid during the day. A third clutch was produced by a mixed white/red pair (white male and red female).

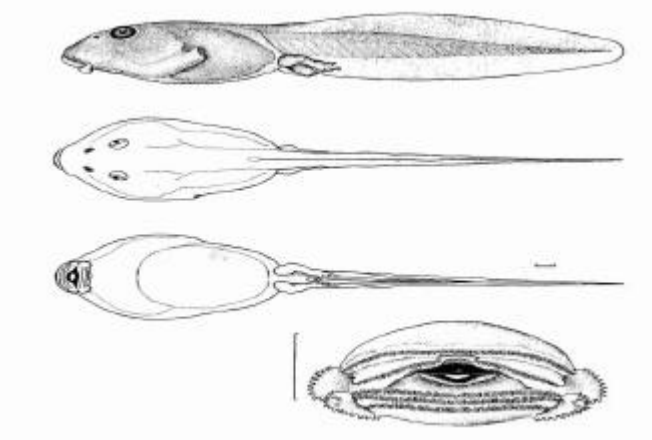
Amplexus of a 'white' pair of *Bufo brongersmai*.

Photo: S. Bogaerts

On January 19, two days after oviposition, the first clutch hatched at 20°C. At a lower temperature the eggs take much longer to hatch (at 15°C it took five days). Larvae of this first clutch were distributed among five people (Rob Veen, Axel Groenveld, Frank Pasmans, Max Sparreboom and Tonnie Woeltjes). This first clutch turned out to be the most successful; hardly any larvae died. A large part of the eggs of the second clutch were infected with fungi, and later on the remaining larvae succumbed as well. Larvae of this second clutch were only distributed to Rob Veen and Frank Pasmans. Many larvae from the third clutch hatched but died fairly soon after because of water contamination. Shortly after hatching, the tadpoles need to be transferred to a large aquarium as the empty egg strands start to decompose and rapidly contaminate the water.

## REARING THE LARVAE

Immediately after the first clutch of eggs was produced, I contacted Ralf Liebetrau for additional information on rearing the larvae. He advised me to maintain the larvae at a temperature of 20-25°C, not to feed the animals too much, and to mostly feed them fish food (such as Tetramin), trout pellets, vegetable matter, and occasionally some animal protein, such as frozen red mosquito larvae. He also recommended removing the slow-growing tadpoles and using them to feed the aquatic salamanders. In addition, there needs to be a sufficient supply of springtails and fruit flies available for the juvenile toads to eat after they transform. Ralf Liebetrau also fed his toads lots of mites (which are easy to produce by keeping your reproductive stock of fruitflies excessively wet – this will ensure that mites will rapidly take over). He raised the juvenile toads in a terrarium with moist tissue and small pieces of bark. This is labour intensive but allows one to quickly assess the young.
Two Austrian researchers investigated the different larval stages of *Bufo brongersmai* (GRILLITSCH & GRILLITSCH, 1987; GRILLITSCH et al., 1989). For detailed descriptions of the larval stages I refer the reader to these publications. The authors state that because this species has been bred in captivity they can demonstrate a full range of developmental stages. The animals investigated originated from Mr. Sochurek and are therefore from the same source as my 'white' animals (pers. comm. M. Laubner).



Typically developed larva of *B. brongersmai* (stage 37). From top to bottom: lateral, dorsal, ventral view, and oral disk. Bar represents 1 mm. Reproduced with authors' permission from GRILLITSCH et al. (1989).

First, after about one week, a large number of tadpoles were distributed to the people mentioned earlier. Those larvae were reared under different conditions (see table). The larvae were kept in glass or plastic aquaria, sometimes with only some aquatic vegetation for decoration. The larvae in my possession were maintained at room temperature. Some tadpoles I kept at a lower temperature (approximately 10-15°C), but they developed very slowly. Rob Veen also kept his larvae at a low temperature (10-14°C). These also developed slowly or withered (at temperatures below 10°C). These particular larvae were intended as food for Rob Veen's *Triturus* sp. They required at least three months to reach metamorphosis! It was striking that the little toads maintained an aquatic lifestyle for one to two weeks after their metamorphosis.

The net result of rearing these toads can turn out well, provided you are selective with the larvae. A good example can be seen with Rob's larvae. Out of the 180 larvae that I initially gave him, 100 died from contaminated water. I then gave him an additional 80 larvae taking his total up to 160 larvae. He split these up into three groups (see table). After one month, the 18 largest larvae of group 1 (n=100) were kept and the rest were fed to other animals. All 18 of these tadpoles metamorphosed completely. All of the larvae in group 2 (n=10) also metamorphosed completely. After six weeks, on February 2, 2000, the 35 largest tadpoles of group 3 (n=60) were selected. These also completed their metamorphosis successfully. Rob raised the animals in group 2 at the highest temperature, 28°C, resulting in the complete metamorphosis of all larvae by February 13. All of the other larvae were maintained at a temperature of 26°C. The last tadpole in group 1 finished its metamorphosis on March 14, while the last one in group 3 was finished by March 17. There is a generous two week difference between the metamorphosis of my animals and Rob's, as the first of my larvae metamorphosed on March 2 at a water temperature of 20°C.

| Name | Density (#/litre) | Food | Temperature | Duration of development from egg to metamorphosis (days) and colour of parents (r = red and w = white) | Average length at Metamorpho-sis (mm) |
|---|---|---|---|---|---|
| Sergé Bogaerts | 5-10 | Tetramin, vegetable matter, Frozen red mosquito larvae | 15-20°C | 42 –70 (r)<br>55- 84 (w) | 11.1 (n = 45)<br>10.4 (n= 21) |
| Rob Veen (group 1) | 10 | same | 26°C | 28-34 (w) | 10 |
| Rob Veen (group 2) | 1 | same | 28°C | 24-28 (w) | 11 |
| Rob Veen (group 3) | 3 | same | 26°C | 24-30 (r) | 10 |
| Max Sparreboom | 10 | Lettuce, Tetramin (with carotene), chalk | 13-25°C | 45-54 (w) | 10 (8-12) |
| Frank Pasmans | 3-6 | Endives, chicory, Trout pellets | 20-22°C | 50-60 (r + w) | 10-12 |
| Grillitsch & Grillitsch (1987) | 2 | Tetramin, lettuce | 20-24°C | 15-20 (w) | 11.6-11.9 |

Table: Various data concerning rearing of the larvae of *Bufo brongersmai*.

The most striking aspect of our data is that our findings do not match the results of GRILLITSCH & GRILLITSCH (1987). According to our results, the development from larva to metamorphosis should last much longer at the temperatures they used. Possibly, this can be explained by the fact that in our animals the development from egg to larvae took place at lower temperatures (they were maintained at a temperature of 15–20°C).
Additionally, a higher density of larvae may be of influence on the larval length at metamorphosis. If lower densities are maintained the animals appear to metamorphose at a larger size. We did not keep track of how often the water was changed. Frequently changing the water may contribute to a larger size at metamorphosis (pers. comm. T. Woeltjes). It is noteworthy though that a high density of larvae does not seem to hinder their growth, while water contamination and food affect development.
Despite Ralf Liebetrau's advice, I tried to raise too many larvae. Excited about the large number of offspring I thought it a shame to feed most of them to my other animals. However, the subsequent amount of work (changing the water and feeding the young after metamorphosis) turned into an almost full-time job. In the end, most toads died anyway because it turned out to be impossible to feed about two hundred animals.

## REARING THE TOADS

The juvenile toads completed metamorphosis at a size of 8-12 mm after 24 to about 90 days, at the most. They crawled onto land while a large part of the tail was still present. The little toads would drown if not enough suitable locations were available for them to crawl on land. The tadpoles that were still present in the water would quickly devour the victims. The little toads would start eating immediately after metamorphosis, even with the remainder of the tail still attached.

One week old *Bufo brongersmai*.

Photo: S. Bogaerts

They were fed small fruitflies and their larvae; mites (which Ralf Liebetrau used as food) were not available to any of us, or only occasionally as an unwanted by-product of our fruitfly breeding stock.
Some of us would feed the toads every day (Rob Veen), others only a few times a week. The animals need lots of food and you can feed them almost constantly. If they do not receive food in time, the little toads will become lethargic and rapidly lose weight.
I kept the toads in small groups of 10-15 animals per terrarium, which measured 20x15x5 cm (lxwxh). The decor was very sparse, with some moist tissue and stacks of moist peat and bark. The animals were maintained at room temperature. They appeared to be very sensitive to humidity and the animals that were kept in drier conditions developed considerably better: faster and looked healthier. The amount of food that I needed to drag in became a big problem. I had severely underestimated this. The little toads ate tremendous amounts of food but grew very slowly at room temperature. At higher temperatures (created with the aid of a light) the toads developed much more quickly. Rob Veen kept his toads relatively warm and fed them every day. Under those conditions they may measure 13-14 mm after a week. The largest animals measured 20 mm already, only slightly over a month after metamorphosis (March 24)! Depending on their size, the juveniles are fed fruitflies and tiny crickets, but later on they also receive curly-winged flies and buffalo worms.

Young *Bufo brongersmai* at feeding time.

Photo: S. Bogaerts

## DISEASES

These toads are relatively hardy. The problems that I faced were usually due to poor hygiene. In other words; you need to clean the terrarium frequently to avoid most problems. This rule applies to every phase in the life of this toad, from the larval phase through juveniles to adults. I have personally lost some animals due to contamination of the water basin. These animals like to defecate in the water basin. They also use the same water for rehydration - a combination that quickly led to problems. The toads developed red hindlimbs and a dull-looking skin, and died soon after. Now I clean the water basin twice a week. You could also remove the water basin completely but then you need to spray a part of the terrarium on a regular basis. In addition, drought may be fatal. Even though these are animals of the semi-desert, a lack of moisture will irrevocably lead to dehydration and, eventually, death.

Max Sparreboom has lost many juvenile toads when rearing them. After a while, the toads started to display symptoms of paralysis in the hind limbs. The phenomenon appeared as a calcium carbonate-deficiency, even though Max already added this substance to the water during the toad's larval phase. Possibly, the quality of the food is a factor here. Max mostly fed his animals commercially obtained prey animals, but with added calciumcarbonate and minerals.

## IN CONCLUSION

Brongersma's toad, or the Anti-Atlas toad as it is called in German, is one of the very few species of true toads that can be bred successfully and repeatedly. Only rarely are other *Bufo* bred in captivity. For example, BILLING (1980) reports a successful reproduction of *Bufo viridis* after moving his animals from one greenhouse to another. His new greenhouse was more spacious, had a larger water basin, and immediately after the move a warm spell occurred. Of the eight animals that he moved, one couple reproduced. More luck than planning, I would say. And this is typical for breeding toads in captivity.
In 2001 I successfully bred these animals again, and I gave many hundreds of larvae to fellow hobbyists. Hopefully, this will create a basis for a wide distribution of this beautiful toad in terrarium circles. In addition, I truly hope that this article will inspire all the other keepers of toads to experiment more, possibly leading to successful breeding attempts.

## ACKNOWLEDGEMENTS

Without the help of Axel Groenveld, Frank Pasmans, Max Sparreboom, Rob Veen, and Tonnie Woeltjes, this paper would never have been written. I would especially like to thank Ralf Liebetrau who gave me advice that led to a successful breeding. Thank you all for your efforts!

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