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CAPTIVE BREEDING OF THE RHINOCEROS-HORNED VIPER, *BITIS NASICORNIS*

JOHN AKESTER

44 Forbes Avenue, Harare, Zimbabwe

INTRODUCTION

Bitis nasicornis (Shaw), the Rhinoceros-horned Viper, Nose-horned Viper or River Jack, is one of the less well documented members of the African genus *Bitis* and Pitman's comprehensive description of the species is possibly one of the most informative (Pitman, 1974).

Bitis nasicornis inhabits the rain forest areas of tropical West Africa and is found as far east as W. Kenya and N.E. Tanzania. It is a large, stout snake – being one of the 'Big Three' African vipers *Bitis gabonica gabonica, Bitis arietans* and *Bitis nasicornis),* reaching an average length of just over one metre. It is just not possible to describe the beautiful markings and colouration of a newly sloughed individual with its complicated geometric pattern in olive, crimson, blue, yellow and rich brown, with a black javelin-shaped marking on the head. However, very soon after sloughing these rich colours start to fade rapidly and within a few weeks the snake has taken on quite a drab look when compared with its former gaudy appearance. It is interesting to note that the Gaboon viper, *B.g. gabonica,* although not being quite as colourful when freshly sloughed, keeps its colouration far longer than *B. nasicornis.* Its most striking characteristics are the cluster of three pairs of horns on the nose which give the snake its popular names, and the very strongly keeled dorsal scales which resemble miniature shark's fins.

Because of the lack of information about this species it was felt that a study should be made of its natural history and, in particular, its breeding habits – closely following the techniques used by us to study its congener, *B.g. gabonica* (Akester, 1979, 1984).

In May 1985 a pair of *B. nasicornis* was received in Harare, Zimbabwe from Ghana, having been in captivity there since September 1984. They were both sub-adults from the Mpraeso district of Ghana (06° 35'N 00° 44W). The immediate problem, once our customary quarantine period had elapsed, was to decide on how to acclimatise them to the conditions in Zimbabwe which are very different from those which they would experience in Ghana. May to September is the dry winter season in Zimbabwe with night temperatures falling to below freezing on occasion with very little moisture in the air at all, as opposed to Ghana where they would seldom experience temperatures below 15°C coupled with a very high humidity. They were therefore housed in heated, glass cages which had a thermostatically controlled minimum temperature of 16°C – the humidity being kept at a high level by daily spraying the cages with water.

While they were housed in the glass cages they were fed on mice and small rats and steps were taken to eradicate the high helminth infestation which faecal analysis had indicated that they both had when received. In October 1985 they were transferred to small, outdoor enclosures and remained there until the end of April 1986 when they were returned to the heated, glass cages for the winter. In August 1986 they were again transferred – this time permanently, to a large, outdoor enclosure some 14m^2 in area planted with thick vegetation and provided with a large pool of water. This enclosure is protected by a security fence which is covered by clear plastic sheeting in the colder months (May to September). At the time of transfer the minimum night temperature in the enclosure was +9°C, but, on clear nights during mid-winter, the temperature can drop to as low as +2°C. The enclosure has a built-in sprinkler system which is operated regularly in the dry season, and as and when required during dry periods in the summer months.

When gravid the female closely followed the behaviour patterns observed in gravid *Bitis g. gabonica* females (Akester, 1984) and, as the estimated time of parturition approached, the

pool was drained and the vegetation thinned out to avoid the neonates drowning in the pool and making it easier to locate them in the enclosure.

Once a parturition had taken place the neonates were removed from the enclosure as soon as possible and transferred to glass cages similar to the ones used to house the adults and, as they started to feel well and had sloughed for the second time, were transferred again – this time to a small, outdoor enclosure.

OBSERVATIONS

Upon receipt the snakes were weighed and measured – this being repeated at irregular intervals – as and when the opportunity arose as shown in Table 1.

TABLE 1. Mean mass and length of adult *B. nasicornis*

Date	Male		Female	
	Mass (g)	Length (mm)	Mass (g)	Length (mm)
May 1985	658	800	622	750
October 1985	1042	925	1017	850
November 1986	2050	1000	2450	1000
August 1987	2200	1100	3150	1120
April 1988	2500	1170	–*	1130

* The female was not weighed just prior to parturition to avoid the possibility of stressing her.

B. nasicornis are placid in temperament but can be aggressive when aroused. *B.g. gabonica* are also very placid but when really angered hiss loudly and draw back into a striking coil giving ample warning of their displeasure. However, *B. nasicornis* will strike without any warning whatever and sometimes even without a great deal of provocation. It should be noted that it is not safe to hold them by the tail as it appears to be slightly prehensile and they can, and do, throw themselves upwards and backwards to strike at the hand holding them – this is something that an adult *B.g. gabonica* is not able to accomplish. Possibly because of their partially prehensile tails *B. nasicornis* are able to climb quite well and it is not unusual for us to find the male some distance above the ground in the vegetation. Their affinity to water has often been stressed (Pitman, 1974. Stucki-Stirn, 1979. Ditmars, 1931) hence the name 'River Jack', but we have not found them to be any more fond of water than *B. gabonica*. The enclosure contains a very large pool of water but they are seldom found near to it, laying in it or even drinking from it. They do, however, become very active during rainfall or when the sprinkers are turned on – usually taking the opportunity to drink from rocks, vegetation and from off their own bodies. They are, however, powerful swimmers if it becomes necessary for them to take to the water.

The pair tended to keep apart, staying in one place for long periods. However, at 16h00 on 21st March 1987 the pair were observed copulating with the male being dragged through the vegetation by the female. The pair broke apart at 17h15.

22nd March: The sprinklers were turned on at 12h00 and 12h15 the male was observed to be moving up over the female with rapid tongue flicking and head jerking. The female at first moved away from the male but he persisted and at 13h10 they were again coupled, with the male being dragged across the enclosure. They remained coupled until 16h00.

28th March: Mating behaviour at 10h30 and the pair were coupled at 11h30 – separating at 13h30.

11th April: The sprinklers were turned on at 10h30 and at 11h15 the male was observed to have chased the female to the top of the bunker and, as the female moved off, the male actually fell off in his haste to catch her. At 11h30 the pair were coupled – separating at 14h30.

No more activity was observed until 1st June when at 17h15 the couple were again in a mating situation with the male being dragged. No more mating activity was noted after this date.

The female continued to feed well until December when she refused food from time to time. She commenced to shuttle between patches of sunlight and shade and in the late afternoons would coil up tightly – remaining like this until the following morning when the sun was again on the enclosure. About this time she began to get very aggressive and continually 'warned-off' with head flashing and hissing.

In late March she began to show signs of sloughing and on 18th April she sloughed very badly – the skin coming away in small pieces. This fragmentation of the skin also takes place in gravid *B. gabonica* females and is one of the indications that parturition is imminent.

At 17h00 on 6th May 1988 it was obvious that she had given birth during the day but all that was immediately visible were four stillborn young, three infertile eggs and one very small, live but unsloughed baby. A thorough search was made but, owing to the dense vegetation, only two other neonates were discovered before it began to get too dark to look further.

7th May: As no more neonates were visible, the adults were removed from the enclosure and the sprinklers turned on. Almost immediately numerous babies were observed to be moving around and during the course of the day thirty-seven were collected. During the following day two more were found – making a total of forty-two live young. In both colouration and markings the babies were exact replicas in miniature of the adults – but, of course, as with *B.g. gabonica* no two were exactly alike. The adults were returned to the enclosure and the neonates were sexed, weighed and measured (Table 2).

TABLE 2

Mean mass and length of 42 neonate *B. nasicornis* born 6th May 1988. 27 males and 15 females.

	Mean Mass (g)	Mean Length (mm)
Males	19.81	243.96
Females	20.00	241.94
Total	19.89	243.09

CARE OF THE YOUNG

With the exception of the small, unsloughed male all the young were perfect specimens and all had sloughed prior to collection from the enclosure. The unsloughed male was assisted by soaking in warm water with manual removal of the skin, but it never really thrived and eventually died about two weeks later.

The babies were offered new-born mice within a few days of birth and, although a few individuals took them readily, it became apparent that getting the majority to feed was indeed going to be a very difficult task. Over the next few weeks more were induced to eat by putting food in their mouths, but this left a small number which would not take food even if were placed in their mouths, and so it eventually became necessary to force feed them. It is interesting to note that the females fed more readily than the males and all of the ones which eventually had to be force fed were males. At the time of writing (December 1988) most of the young are still having to be hand fed. A number of the young were passed over to the Bulawayo Natural History Museum and I have been informed that a number of reluctant feeders have readily taken small toads (D:G. Broadley, pers. comm.). At this time of the year in Harare small toads are not yet available so we have not had the opportunity to try this for ourselves. In any case, we would like to persevere with the feeding of mice as this will make feeding easier in the future by eliminating the need to wean them back to rodents. It is interesting to note that baby *B. arietans* readily take small toads but change over to rodents as they mature.

Although the individual babies have received approximately the same amount of food, it has become apparent that those which voluntarily took food are doing better and growing faster than those which were induced to feed by putting food in their mouths and these, in turn, are doing better than those which had to be force fed. The former are now, on average, over twice the size of the latter (Table 3).

TABLE 3.
Mean Mass and Length of 24 baby *B. nasicornis* as at 5th November 1988.

Group 1. Voluntary feeders
Group 2. Hand fed
Group 3. Force fed

Group	Mean mass (g)	Mean length (mm)	No. males	No. females
Group 1	69.94	340.60	3	5
Group 2	42.79	305.41	6	6
Group 3	33.23	296.25	4	–

We have found that some baby *B.g. gabonica* also give problems with feeding but in the one hundred and fifty or so which we have bred over the past few years, we have never yet had a litter which was as difficult as this litter of *B. nasicornis* is proving to be.

All the babies sloughed immediately after birth and some started to slough for the second time at about three months. This depended on how well they were doing, and some are now undergoing their third slough at seven months, while two are still only just starting their second.

The litter has now been split into five as a precaution against accident or disease, with one batch going to the Bulawayo Natural History Museum, and another batch to another herpetologist. The remaining ones are split into good, medium and poor feeders – the good feeders are now in an outside enclosure while the others are still in indoor cages.

DISCUSSION

When the breeding of *B. nasicornis* was first considered it became obvious that, to be reasonably sure of success, the snakes should be given as much space as possible in conditions which were as natural as possible. Space was no problem nor was the provision of thick vegetation, a bunker to hide in and a sprinkler system to provide for watering. However, all this entailed the use of an outdoor enclosure in a climate very different from that which would be experienced by the snakes in Ghana and initially we were very worried by this aspect. However, we need not have concerned ourselves as they acclimatised extremely well to the extent that both the male and the gravid female were left in the enclosure to over-winter, where the minimum night temperatures dropped to as little as +2°C on some occasions. During the day the gravid female basking in the sun could experience temperatures in excess of 30°C. This did not seem to have an adverse effect on her except for perhaps the rather long 'gestation' period of eleven to fourteen months (the first confirmed mating took place on 21st March 1987 and the last on 1st June – the births taking place on 6th May 1988). Although a very close watch was kept after 1st June no further matings were observed and, from the positions of the male and female in the enclosure, no contact took place between them thereafter. Again we are faced with the possibility of sperm retention, delayed fertilisation or delayed development of the embryos as with *B.g. gabonica* (Akester, 1979).

B.g. gabonica has a well defined mating and breeding season in Zimbabwe lasting from late March until early June and coinciding with the onset of the colder months and the end of the rainy season (Akester, 1979, 1984). However, in the absence of relevant data it was assumed that the mating season would, in the case of *B. nasicornis*, not be so well defined and it came as a surprise that it coincided exactly with that of our indigenous *B.g. gabonica*. Whether the natural breeding and mating season just happens to fall at the same time as that of *B.g. gabonica* in Zimbabwe, or whether the captive *B. nasicornis* have adapted and adjusted to the conditions in Zimbabwe is a difficult question to answer.

Plate 1. Adult *Bitis nasicornis* showing cluster of three pairs of horns and very strongly keeled dorsal scales which resemble a miniature shark's fin.

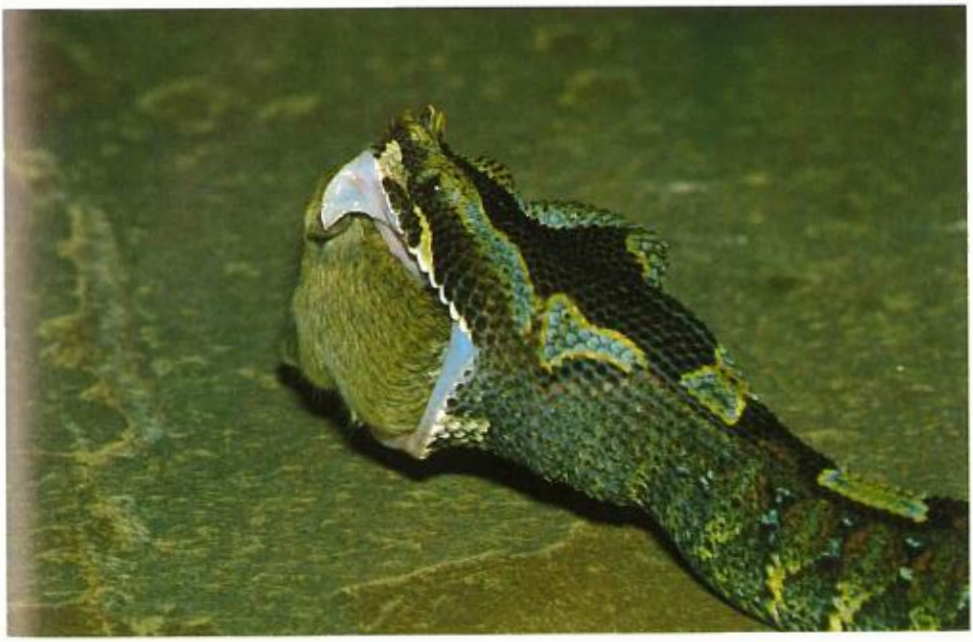

Plate 2. Head of feeding juvenile *Bitis nasicornis* showing prey being pulled into mouth with fangs.

The pre-natal behaviour of *B. nasicornis* shows an interesting parallel with that of *B.g. gabonica*. Both species become very aggressive in the latter stages of pregnancy with head flashing and minatory hissing but usually without actual strikes being made. The final slough before parturition is always fragmentary with the skin breaking up into small pieces leaving bits sticking to the body for several days. Although gravid *B.g. gabonica* females usually take no food at all during the whole period of pregnancy, the *B. nasicornis* female fed well at the beginning and only in the later stages stopped feeding altogether. Gravid females of both species bask in the sunlight but towards evening coil up tightly in places where the heat is retained – for example, among the rocks and on the cement surrounded of the drain in the enclosure.

Although it is not possible to draw accurate conclusions based on the evidence of a single litter of *B. nasicornis*, it would appear that it is more difficult to induce neonate *B. nasicornis* to commence feeding on rodents than it is to start feeding baby *B.g. gabonica* on them.

It is intended that this study will continue to record the growth rate and behaviour patterns of the young *B. nasicornis* and ultimately, when they are mature, extend to the examination of the possibility of male combat occuring in this species.

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