CAPTIVE REPRODUCTION OF *ELAPHE MANDARINA* (CANTOR 1843)

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INTRODUCTION

The adults in this report were originally hatched from a clutch of eggs laid by a wild caught gravid female, imported by an Italian dealer. Subsequently Mike Nolan, in the UK, purchased 2.1 hatchlings from this clutch. The hatchlings were raised over the next three years to adults, although unfortunately one of the two males died, possibly aggravated by low humidity (Mike Nolan, personal communication). During 1991 Mike successfully bred from the remaining pair, resulting in one surviving male hatchling from an original clutch of three eggs.

The two adults plus the remaining male hatchling were obtained from Mike Nolan on 14th December 1992 by a private consortium of British reptile breeders, including the author. The two adults were lodged with the author while the male hatchling was raised by another consortium member.

This paper describes the authors first year's maintenance and successful reproduction with this pair of *Elaphe mandarina*. The results appear to confirm the previous conclusions of Trevor Smith (1989).

ACCOMMODATION FOR ADULTS

The adult pair had been initially raised from hatchlings in well ventilated polythene boxes, on a damp substrate of pine bark chippings.

Following the consortium's obtaining the adults in December 1991, the pair were set up individually in polyethylene meat trays, measuring 630mm long x 380mm wide x 150mm deep, within a close fitting drawer compartment system, used to house various other Colubrid snakes.

A soil heating cable (Jemp Ltd.) was set in a routed groove, covered with aluminium tape, to distribute heat more evenly, approximately 150mm from the rear of the base of each compartment. The heating cable was controlled by a thermostat with a remote air temperature sensitive probe placed adjacent to the heating cable. This allowed for the control of a precise hotspot within the trays whilst not particularly controlling overall air temperature. In addition the trays could be pulled forward away from the heating cable so that only the rear edge of the tray was heated, or pushed in to provide a hotspot approximately 150mm from the back of the tray.

The room containing the drawer system was heated by a thermostatically controlled electric fan heater to provide a reasonably controlled ambient air temperature. An extractor fan sited at the top edge of the west facing wall of the room was controlled by a thermostat placed in the centre of the room's ceiling.

The trays were furnished with clean white wood shavings and two 2kg polythylene margarine tubs, both with 60mm square holes cut into the lids. One contained fresh water and was placed at the front of the tray, furthest from the heat source. The second was placed in the middle of the tray and was packed with damp sphagnum moss.

TEMPERATURE AND HUMIDITY CONTROL FOR ADULTS

Following receipt on 14th December 1991 the heating cable was already set to a temperature of 15°C, for the hibernation of the other housed snakes. For the *E. mandarina* their trays were pulled forward, so that only the back edge of the tray was heated. The ambient room temperature was already set at 10°C, and the extractor fan set at 15°C.

Micro-humidity was provided in the tub by packing it with damp sphagnum moss. The specimens both spent most of their time in their "wet-boxes" during this hibernation period. They were observed to be quite active at times however and were seen to drink from their water tubs during this hibernation period. The moss was sprayed with water at a temperature of approximately 10°C from time to time to maintain an even dampness without actually becoming wet.

Water was replenished frequently even during hibernation. Ashley and Burchfield (1966) found that snakes were attracted to fresh water and were stimulated to drink. They recommended changing the water daily.

E. mandarina appears to suffer if not provided with a high humidity (Smith, 1989) and constant access to fresh water. The provision of a "wet-box" as outlined above seems to provide this requirement, within an enclosed retreat, which allows the snakes to also dry off within the main area of he vivarium, if required. I believe that this is an important consideration for this species to prevent the occurrence of blister disease (necrotic dermatitis), which is well documented (Marcus, 1981 for example).

On the 1st March 1992 the heat tape was reset at 28°C, the room ambient was set at 18°C, and the extractor fan at 25°C. The trays containing the *E. mandarina* were maintained in the pulled forward position. The snakes continued to spend long periods in their "wet-boxes" and were only rarely found basking at the warmest end of the tray. No attempt was made to vary night time temperatures though inevitably there was a night time drop in ambient of 2-3°C. Temperatures recorded at the front of their trays varied between 16-20°C, depending upon ambient room temperature. Temperatures recorded at the warmer end of their trays varied between 23-26°C.

CAPTIVE REPRODUCTION

On the 4th of March 1992, three days following the end of hibernation, three freshly killed weaned mice were placed on the lids of both snakes' "wet-boxes", adjacent to the access holes. Both snakes fed overnight without problem. Four days later the same feeding regime was repeated. On this occasion only the female fed during the night.

The male's refusal to feed was taken as an indication of his readiness to breed. Therefore he was transferred to the female's tray complete with his own "wet-box" on the 10th March. Food was offered at the same frequency and quantity, and most would be consumed overnight, as previously. As all the food was not consumed it was assumed that the male was not feeding, as is often the case with other breeding Colubrid males.

No actual mating was observed, and it was presumed to have taken place at night. For a period from 24th March to the 2nd of April it was observed that the wood shavings were significantly disturbed on three separate occasions. This was interpreted as possible courtship and mating activity. The male was removed to his own tray on 7th April, and resumed feeding on the 16th April.

EGG LAYING AND INCUBATION

The female continued to feed until 19th April, by which time it was apparent that she was gravid. Her post coital slough occurred on the 19th May, and 13 days later on 1st June she laid four eggs in her "wet-box". This compares with a period of 11 days recorded from the post coital slough to egg laying by Gillingham (Smith, 1989).

The eggs were removed from the "wet-box" and transferred to a plastic box containing equal parts by weight of water and vermiculite. Each egg was weighed and measured, and individually marked with a graphite pencil (see Table 1). This box was incubated at temperatures ranging from 30-25°C within a walk-in incubator. The lid of the plastic box was ventilated with several small holes, and the lid was removed daily to inspect the eggs and allow a change of air.

Plate 1. – *Elaphe mandarina* hatchling. *photo: Jon Coote*

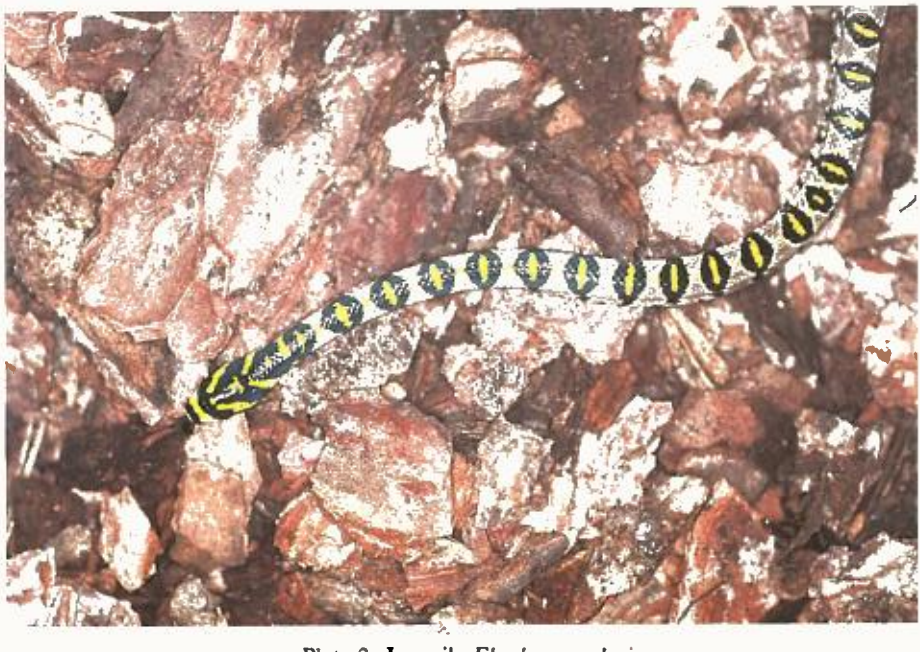

Plate 2. Juvenile *Elaphe mandarina*.

The female continued to remain in the "wet-box" after her eggs were removed, and continued to refuse food, including "pinky" mice. She did "kill" one freshly killed furry mouse, introduced directly into the "wet-box", but did not eat it. She finally began feeding again on the 16th July. This may indicate some degree of maternal protection during incubation for this species, coupled with her "killing" the introduced furry mouse.

HATCHING AND HATCHLINGS

The first egg started to hatch on 24th July was observed to have collapsed slightly on 20th July; this probably indicated imminent hatching rather than lack of humidity. The final hatchling emerged from its egg on 27th July. The incubation period was therefore a period of 53-56 days. This compares to 49-54 days recorded by Gillingham (Smith, 1989).

All hatchlings were measured using the "Squeeze-box" technique (Quinn, 1974), weighed, and probed (Laszlo 1975) to determine sex. All four hatchlings were males. (See Table 1).

The squeeze box technique involves trapping the hatchling against a sheet of foam rubber with a clear perspex sheet. Whilst immobilised a line is drawn along the vertebral column of the hatchling onto the clear sheet. This drawn line is then later closely followed with a piece of dacron thread (minimal tendency to stretch) and measured against a rule.

Table 1

No.	Egg weight	Length	Width	Pipped	Hatched	Sex	Total Length	Weight
1	25.5g	67mm	23mm	24/7	24/7	M	334mm	17g
2	21.5g	65mm	22.5mm	25/7	25/7	M	330mm	18g
3	24g	66mm	23.5mm	26/7	27/7	M	343mm	19g
4	24g	69mm	22mm	26/7	27/7	M	339mm	17g

All the hatchlings were individually housed in small well ventilated plastic boxes, complete with miniature versions of the adults' water tubs and "wet-boxes". Initially the hatchlings were kept at similar temperatures to the adults. It was later found however that they were stimulated to feed better at a slightly higher temperature, similar to that commonly used for other *Elaphe* and *Lampropeltis* species (hotspot of 25-30°C).

The hatchlings' first slough was after an average of 9 days. New born "pinky mice" were offered immediately after this first slough. Two hatchlings fed without problem, but the other two only fed after the increase in temperature was introduced.

CONCLUSIONS AND COMMENTS

As predicted by Trevor Smith (1989) the captive hatched and raised adults have presented few problems, provided that they are never allowed to become dehydrated. This simple problem is probably why wild caught animals fail to thrive, as probably their kidneys are irreparably damaged due to dehydration during their period from capture to final captive destination. I believe that hatchlings are particularly prone to dehydrate when sloughing, and remedial attention at this time is advisable.

Feeding presents few problems, and the adults have taken adult dead mice on occasions, though like most snakes they prefer smaller prey if available. Hatchlings appear to require a slightly higher temperature compared to adults to illicit a strong feeding response. It would be wise in future to remove the "wet-box" the female laid in and replace with another. This would probably result in the female feeding more rapidly after egg laying.

Captive raised *E. mandarina* are still quite highly strung animals, but they are not aggressive. They require good security and access to water at all times. Normal temperatures as used for other Colubrids appear to be ideal, unlike the cooler conditions recommended for wild caught animals.

Gillingham incubated two clutches of *E. mandarina* eggs (Smith, 1989), one of six eggs at a temperature of 24-27°C, which resulted in 3 males and 3 females, and one of two eggs incubated at 25.5-27.7°C, which produced 2 males. My incubation of four eggs at 25-30°C also resulted in all males. It is possible that the sex ratio of this particular snake species responds to incubation temperatures, in the same way that turtles, crocodilians and many lizard species do. Lower incubation temperatures than used in this report are therefore currently recommended to obtain equal sex ratios.

A detailed species description and natural history for *E.mandarina* can be found in Smith (1989), complete with recommendations for captive care, particularly of wild caught specimens.

In conclusion the captive care of *E.mandarina* appears to be, in most respects, very similar to that of *Elaphe situla*, which I also maintain in my collection.

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