

THE SECOND GENERATION OF CAPTIVE BRED *RHABDOPHIS TIGRINUS*

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Two males and one female hatched at the beginning of August 1980 and raised together successfully reproduced in 1982, but sexual activity had already occurred one year after hatching (on 10 August 1981) when the female reached about 70cm in length. Both males were smaller and one of them started to court the female by flicking his tongue over her dorsum and pressing his lower jaw against her body in order to stimulate her to crawl, and coiling his tail around hers. The movement of the female induced increased activity in the male. This behaviour continued until the end of September. However, in October the snakes became apathetic and stopped feeding, so I decided to put them into the refrigerator (on 1 November).

They were removed on 18 February, 1982 and courtship occurred the next day. A week later the second male also showed interest in the female — its interest increased noticeably after the female shed its skin. Mating activity was continuous until the end of February, and was not interrupted even when the female was swallowing frogs. The female ate the last frog 10 days before egg laying. Twelve eggs were laid on 20 April (age of female 1 year 8 months and 17 days) between 5.30 pm and 7.00 pm. The mean size of the eggs was 29.0 x 16.0mm. All of them were fertile. Courtship behaviour and mating recommenced immediately after egg laying and continued until the end of April. At the beginning of June the eggs reached their maximum size. The largest one reached 39 x 27, \bar{x} = 35.0 x 24.7mm, so their volume increased about three times (max 3.8). Seven young of about 180mm in length emerged from the eggs on 4-7 June after 35-38 days of incubation. A further 5 died just before hatching (their lengths were: 183, 187, 181, 166, 187mm (\bar{x} = 180.8mm). Shedding occurred a week later (compare Sura, 1981).

The second clutch of 9 eggs was laid in the afternoon on 8 June, of which one was infertile and another not properly developed. Their sizes: 36 x 16, 33 x 17, 33 x 16, 33 x 17, 34 x 17, 31 x 17, 34 x 18, 35 x 17 (\bar{x} = 33.6 x 16.9mm) and 22 x 14mm (undeveloped), a little larger than the previous clutch. The period of incubation was slightly longer because I had to leave Kraków for some time and the heating was switched off. Two juveniles only hatched on 21 July, after 43 days; the others died before hatching. Their sizes: 152, 160, 190, 181 and 177 (\bar{x} = 172.0mm). The last one was removed from the biggest egg on 19 July. It measured 42 x 25mm (the egg volume increased 2.7 times). This low reproductive success may have been caused by inbreeding and/or vitamin deficiency. In spite of this, the hatchlings were in good condition and started to eat without difficulties — they prefer "jumping" frogs — tadpoles did not stimulate them in the same way.

In August courtship commenced again, but with less intensity, and continued with intervals until the end of October. The female's last ecdysis occurred on 18 October, when she was noticeably gravid. Oviposition took place at night on 2 November but only 8 eggs were found (one abnormal — 7 with \bar{x} = 30.6 x 17.7mm). Unfortunately the female was very weak and died in the afternoon of the following day. Her oviduct contained a further 13 eggs of similar size, so the total number of eggs produced in 1982 was 42. The total length of the female was 870mm (SVL 735mm); growth rate 558mm in the first year and 142mm in the second. The eggs failed to develop, only one contained an embryo in an early stage of development.

According to the literature known to me *Rhabdophis tigrinus* produces one clutch of eggs in one season, at the end of July. However, it is quite possible that the period of reproductive activity may be extended or at least this may happen in captivity. Male snakes determine the productive stage of the female on the basis of an estrogen-dependent pheromone produced by glands in the dorsal skin (Crews, 1976). However, it was stated recently that the sex attractant pheromone of the female red-sided garter snake (*Thamnophis sirtalis parietalis*) is produced in an active form in the liver under the control of estrogen and is present there and in the circulation, reaching its active site on the skin by passing through the keratinized outer skin cells in an active process

associated with courtship (Garstka and Crews, 1981; Crews and Garstka, 1982). Female *Thamnophis* are not attractive to other males after copulation and this change of female attractivity is a consequence of the deposition of a mating plug by the male (Crews, 1979; Crews and Garstka, 1982).

It is difficult to ascertain the reasons for the last unsuccessful clutch. The female apparently produced sex pheromone for an abnormally long time, and in the light of the above facts this may not have resulted in the deposition of a seminal plug. Such a situation is probably caused by lower testicular activity by the males in autumn. However, the asynchronisation of the time when eggs could be fertilised with the time of insemination should not be excluded. Of course, the physiological factors regulating reproductive function and behaviour of *Thamnophis* may differ from those in other snakes, even closely related, so these noteworthy discoveries of American herpetologists could be extended to other species after special research. But one thing can be pointed out now. A striking correlation exists in European *Natrix natrix* between the size of the ovaries and the abdominal fat body. In females with undeveloped ovaries the fat bodies are very large. When ovaries increase in size the fat bodies show an opposite reaction, so after ovulation only rudimentary fat body can be found. This may be explained with the theory of Crews and Garstka. Gonadotropic hormone causes the follicles in the ovary to secrete an estrogen which in turn causes the abdominal fat bodies to release fatty molecules incorporated in the liver into vitellogenin. The vitellogenin is deposited (with other fatty molecules) deep in the skin, serving as the pheromone that attracts the male for mating. Not going into details, after mating an increased production of vitellogenin is noted. Now it is gathering in the ovary being a precursor of yolk. Thus, a smaller size of fat body is correlated with advanced development of eggs.

Summing up, *Rhabdophis tigrinus* is a very attractive species, simple to maintain in captivity where it readily reproduces. Some failures described here could be avoided though the reproductive cycle of this snake and possible endocrinologic anomalies are still not satisfactorily known.

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